FURUNO

OPERATOR'S MANUAL

Dual GPS

MODEL DD-80

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 Printed in Japan

FIRST EDITION : DEC. 1995
J : APR. 01,2003

PUB.No. OME-43741

(TENI) DD-80(GP-80-D)

OME43741J0

SAFETY INSTRUCTIONS

"**DANGER**", "**WARNING**" and "**CAUTION**" notices appear throughout this manual. It is the responsibility of the operator and installer of the equipment to read, understand and follow these notices. If you have any questions regarding these safety instructions, please contact a FURUNO agent or dealer.

DANGER	This notice indicates a potentially hazardous situation which, if not avoided, will result in death or serious injury.
WARNING	This notice indicates a potentially hazardous situation which, if not avoided, could result in death or serious injury.
CAUTION	This notice indicates a potentially hazardous situation which, if not avoided, could result in minor or moderate injury, or property damage.

⚠ WARNING



Hazardous voltage.
Can shock.

Do not open the cover.
Only qualified personnel should work inside the equipment.

⚠ WARNING

Do not disassemble or modify the equipment.

Fire, electrical shock or serious injury can result.

Turn off the power immediately if water leaks into the equipment, or the equipment is emitting smoke or fire.

Continued use of the equipment can cause fire or electrical shock.

Do not place liquid-filled containers on the top of the equipment.

Fire or electrical shock can result if a liquid spills into the equipment.

Keep heater away from equipment.

Heat can alter equipment shape and melt the power cord, which can cause fire or electrical shock.

⚠ CAUTION

Use the proper fuse.

Use of a wrong fuse can result in fire or permanent equipment damage.

Power the equipment with the proper power supply.

Powering the equipment with a wrong power supply can cause permanent equipment damage.

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FOREWORD

A Word to DD-80 Owners

Congratulations on your choice of the FURUNO DD-80 dual differential GPS navigation system. We are confident you will see why the FURUNO name has become synonymous with quality and reliability.

For over 50 years FURUNO Electric Company has enjoyed an enviable reputation for innovative and dependable marine electronics equipment. This dedication to excellence is furthered by our extensive global network of agents and dealers.

This equipment is designed and constructed to meet the rigorous demands of the marine environment. However, no machine can perform its intended function unless operated and maintained properly. Please carefully read and follow the recommended procedures for operation and maintenance.

We would appreciate hearing from you, the end-user, about whether we are achieving our purposes.

Thank you for considering and purchasing FURUNO equipment.

Features

The DD-80 consists of two dual differential GPS navigator systems and an interface unit. Each GPS navigator consists of a display unit combining a GPS receiver, beacon receiver and video plotter, a GPS antenna and a beacon antenna. The interface unit functions to exchange data between the GPS navigators and external equipment. A high sensitivity receiver tracks up to eight satellites simultaneously. An 8-state Kalman filter ensures optimum accuracy in determination of vessel position, course and speed.

The main features of the DD-80 are

- Comprehensive navigation data displays
- Storage for 999 waypoints and 30 routes
- Alarms: Arrival, Anchor Watch, Cross-track Error, Speed, Water Temperature, Depth, and Trip
- Man overboard feature records latitude and longitude coordinates at time of man overboard and provides continuous updates of range and bearing to that point
- Menu-driven operation
- Bright 122 x 92 mm LCD with temperature compensated tone and brilliance adjustment
- Power consumption is a low 10 W per navigator.
- Connection of autopilot (option) – steering data output to autopilot
- Digital display of water temperature and depth with connection of video sounder having IEC 61162-1/NMEA input
- Memory stores 2,000 points of track and marks
- 3D "Highway" display shows ship's track overlaid on intended course
- Position may be shown in latitude and longitude or LOP (Loran or Decca)
- Navaid information (lighthouse data, lighted buoys, etc.) can be displayed by downloading database from personal computer.

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SYSTEM OVERVIEW

1. Menu Tree

Display selection menu

DISPLAY SEL — Select Display (Plotter 1, Plotter 2, Highway, Navigation and Data displays)

Main menu

MENU ESC

- 1. DISPLAY SETUP
- 2. TRACK/MARK SETUP
- 3. ERASE TRACK/MARK
- 4. ALARM SETTINGS 1/2 — ALARM SETTINGS 2/2
- 5. MANUAL CALCULATION
- 6.
- 7. GPS MONITOR
  - SATELLITE MONITOR
  - BEACON RCVR MONITOR
  - STATION MESSAGE
- 8. SELF TESTS
  - 1. MEMORY, I/O PORT TEST
  - 2. KEYBOARD TEST
  - 3. TEST PATTERN
  - 4. AUTOMATIC TESTING
- 9. SYSTEM SETTINGS
  - 1. PLOTTER SETUP
  - 2. UNIT SETUP
  - 3. DATA1, 3 OUTPUT SETUP
  - 4. DATA TRANSFER
  - 5. DATA4 I/O SETUP
    - DATA4 I/O SETUP 1/2 Out/COM./DGPS
    - DATA4 I/O SETUP "Out" 2/2
    - DATA4 I/O SETUP "Com." 2/2
    - DATA4 I/O SETUP "DGPS" 2/2
  - 6. GPS SETUP
    - GPS SETUP 1/2
    - GPS SETUP 2/2
  - 7. DGPS SETUP
  - 8. LOP SETUP
  - 9. CLEAR MEMORY

Waypoint, route menu

WPT RTE

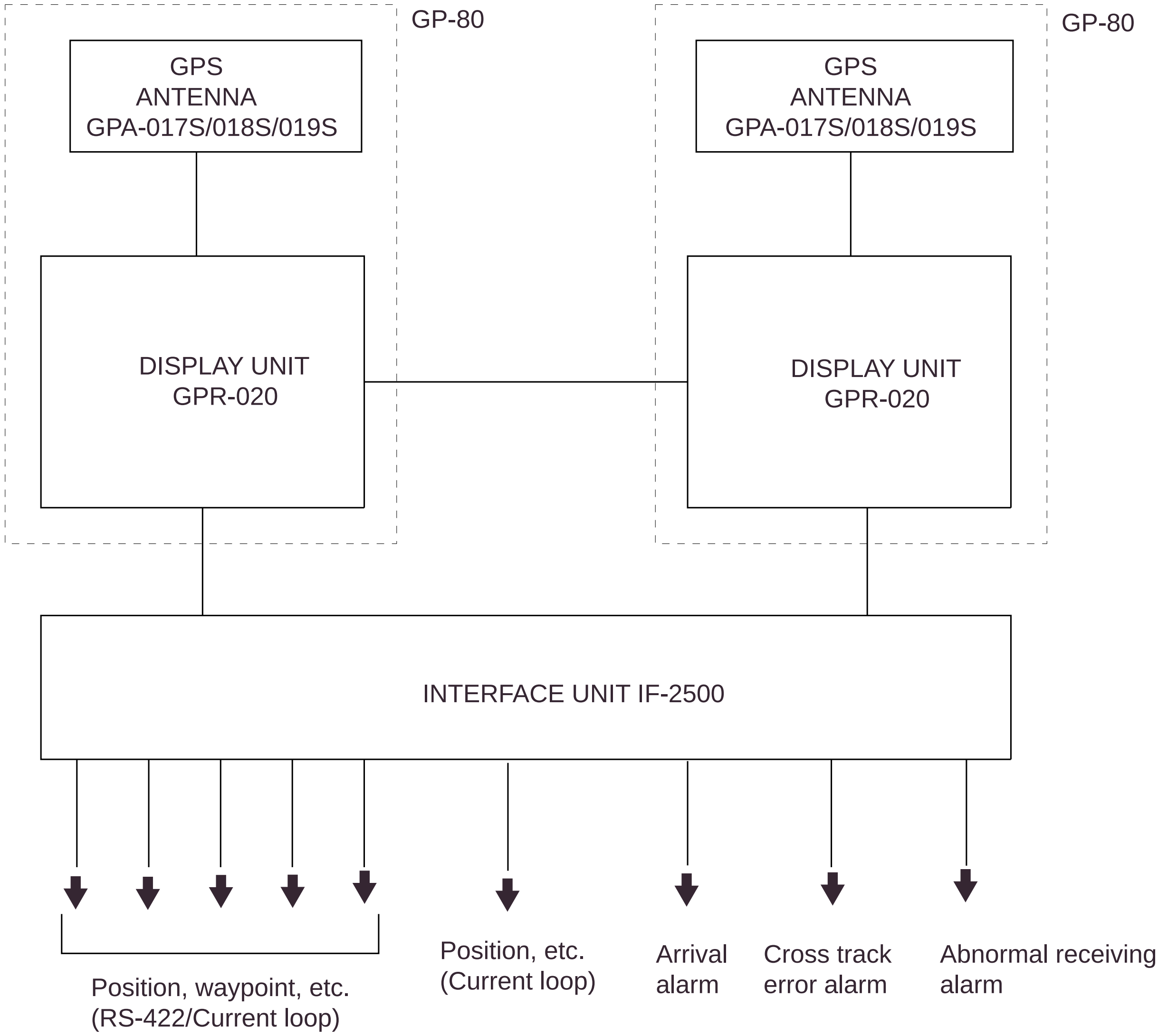
- 1. Cursor
- 2. MOB/Event Position
- 3. Own Ship Position
- 4. Waypoint List — WAYPOINT LIST
- 5. Route Planning — ROUTE LIST

GOTO menu

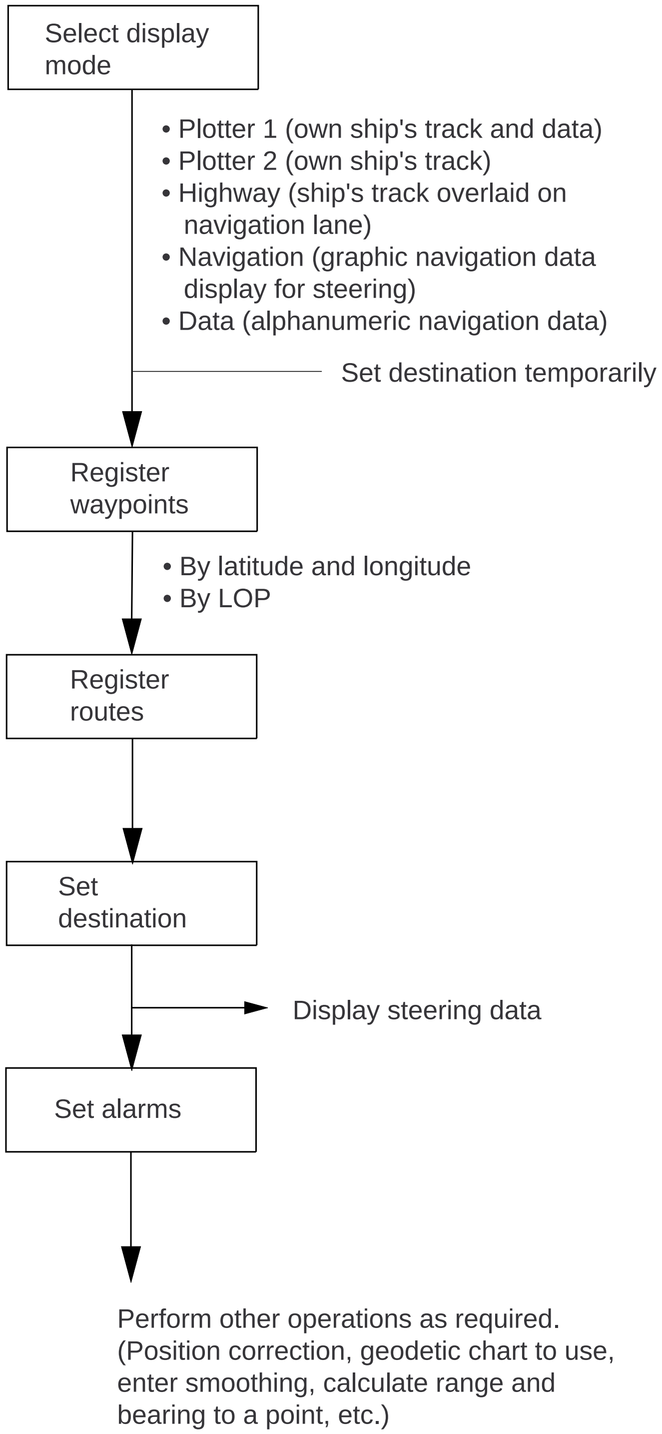
GOTO

- 1. Cursor
- 2. MOB/Event Position
- 3. Waypoint List — GOTO "Waypoint List"
- 4. Route List — GOTO "Route List"
- 5. Cancel

2. System Configuration



3. Operation Flow Chart



1. OPERATIONAL OVERVIEW

1.1 Control Description

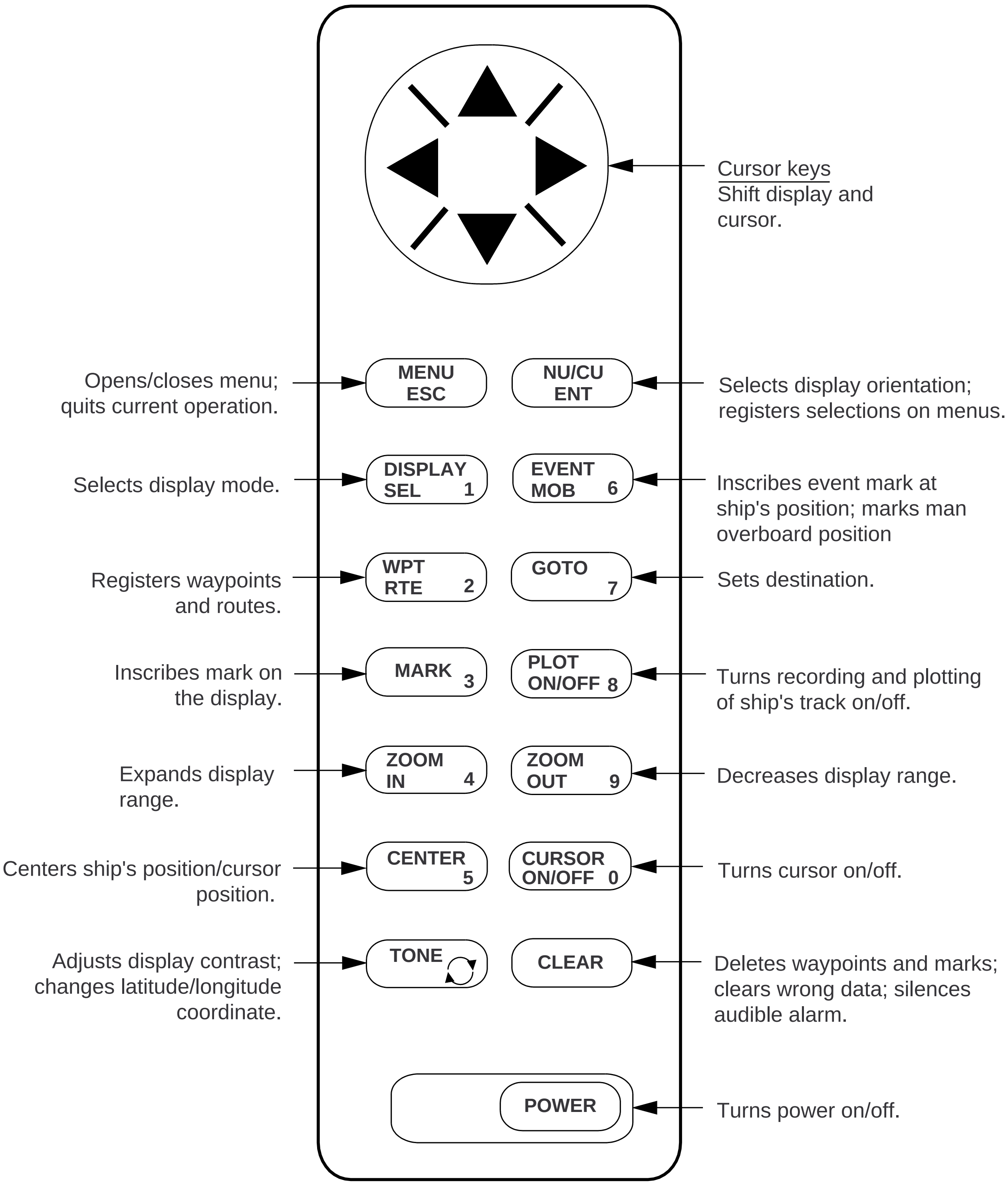


Figure 1-1 Control panel

1.2 Turning On and Off the Power

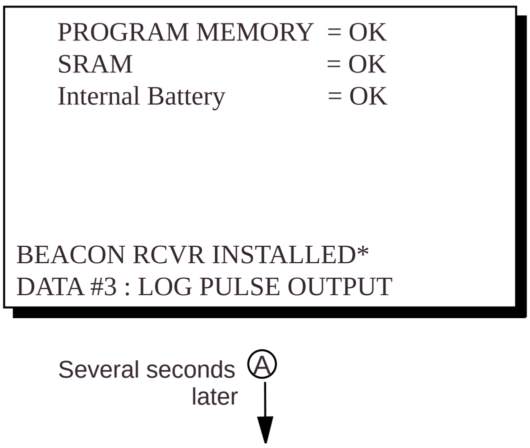
The DD-80 takes about two minutes to find position when turned on for the very first time. Other times it takes about 20 seconds.

Note: The GPS provides highly accurate position information. However, position should always be check against other aids to navigation to confirm reliability, for the safety of vessel and crew.

Turning on the power

Press the [POWER] key.

The unit tests the PROGRAM MEMORY, SRAM and battery for proper operation and shows the results on the display. "BEACON RCVR INSTALLED" appears at the bottom of the display. The unit starts up with the last used display mode and that mode is indicated at the bottom of the display.



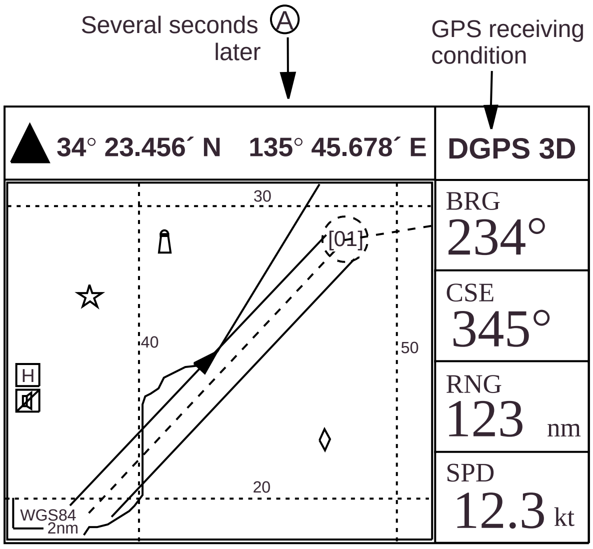


Figure 1-2 Appearance of display when turning on the power

When turning on the power the following occurs:

20 seconds after turning on the power, accurate position (in latitude and longitude) appears on the display.

If position could not be found, "NO FIX" appears at the GPS receiver condition window. When PDOP value exceeds 6 in the 3D mode or HDOP value exceeds 4 in the 2D mode, "DOP" appears to indicate abnormal fixing and the position indication could not be updated.

When the satellite signal is being received normally, one of the indications shown in Table 1-1 appears depending on equipment setting and GPS receiver state.

Table 1-1 GPS receiver indication

Equipment setting	GPS receiver state indication
2D	GPS 2D (normal)
3D	GPS 3D (normal)
Differential 2D	DGPS 2D (normal)
Differential 3D	DGPS 3D (normal)

Note 1: When PDOP value exceeds 6 in the 3D mode, the position fixing method is automatically changed to 2D.

Note 2: The "DEMO" icon appears when the display is in the demonstration mode. To return to normal mode, turn off the power and turn it on while pressing and holding down the [NU/CU ENT] key.

Turning off the power

Press the [POWER] key.

The next time you turn on the power the unit starts up with the last used display mode.

1.3 Adjusting Display Contrast and Brilliance

1) Press the [TONE] key. The display shown in Figure 1-3 appears.

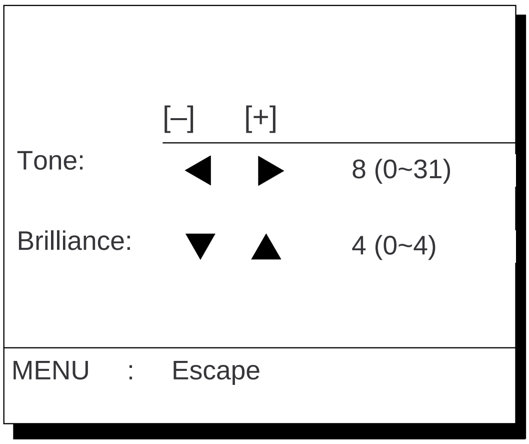


Figure 1-3 Screen for adjustment of display contrast and brilliance

2) **To adjust contrast,** press ◀ or ▶. Current setting and setting range (0–31) are shown to the right of "▶".

3) **To adjust brilliance,** press ▲ or ▼. Current setting and setting range (0–4) are shown to the right of "▲".

Note: Operate cursor keys within 10 seconds after pressing the [TONE] key. Otherwise, the screen for adjustment of contrast and brilliance will be cleared.

1.4 Display Mode

1) Press the [DISPLAY SEL] key. The display shown in Figure 1-4 appears.

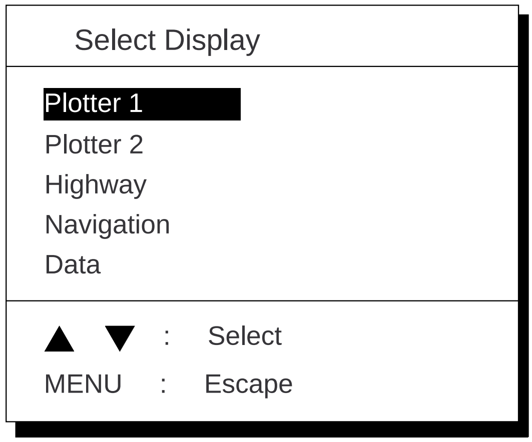
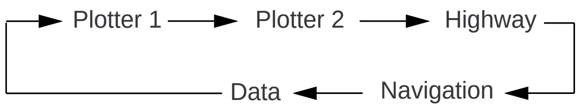


Figure 1-4 Screen for selection of display mode

2) Press the [DISPLAY SEL] key, ▲ or ▼ to select display mode. (When the [DISPLAY SEL] key is pressed, the display mode changes in sequence shown below.) Selected display mode appears about 15 seconds later.



Sample displays of each display mode are shown in the figures on the next several pages.

Plotter 1 display

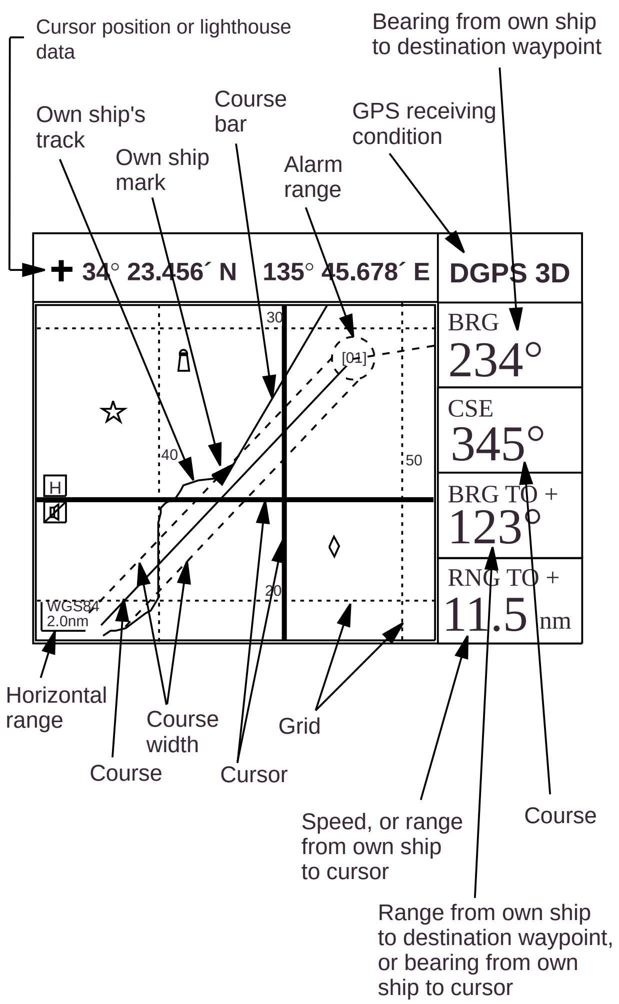


Figure 1-5 Plotter 1 display

Plotter 2 display

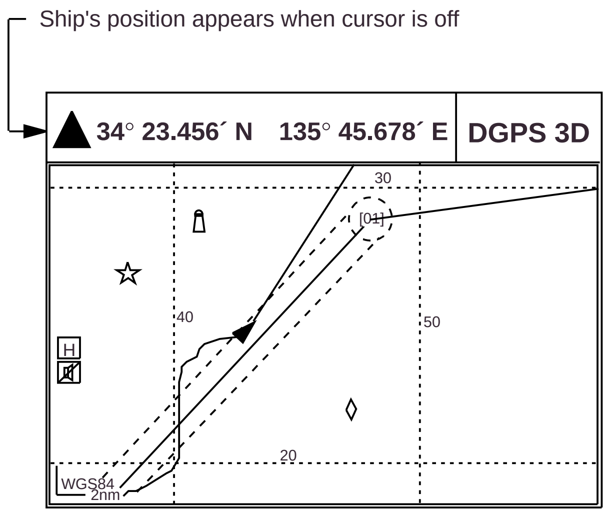


Figure 1-6 Plotter 2 display

Highway display

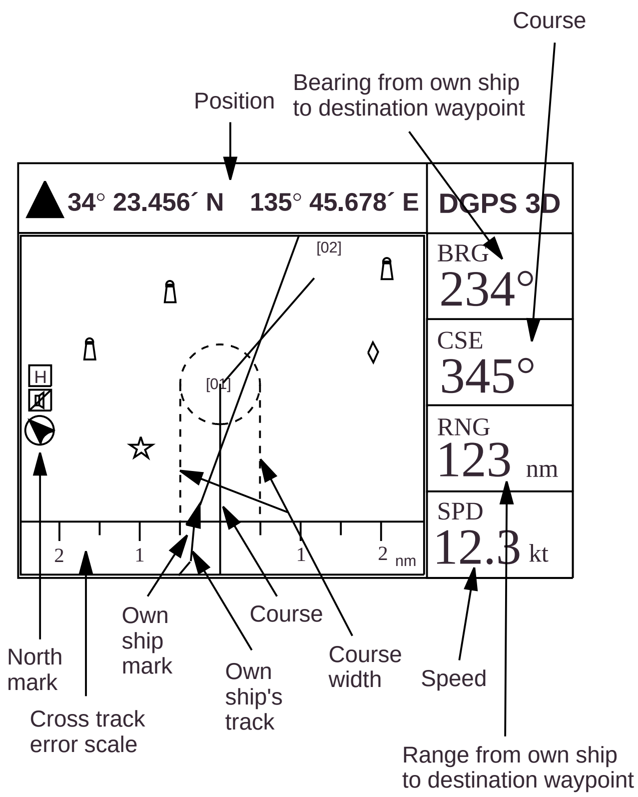


Figure 1-7 Highway display

Navigation display

1) No autopilot connection

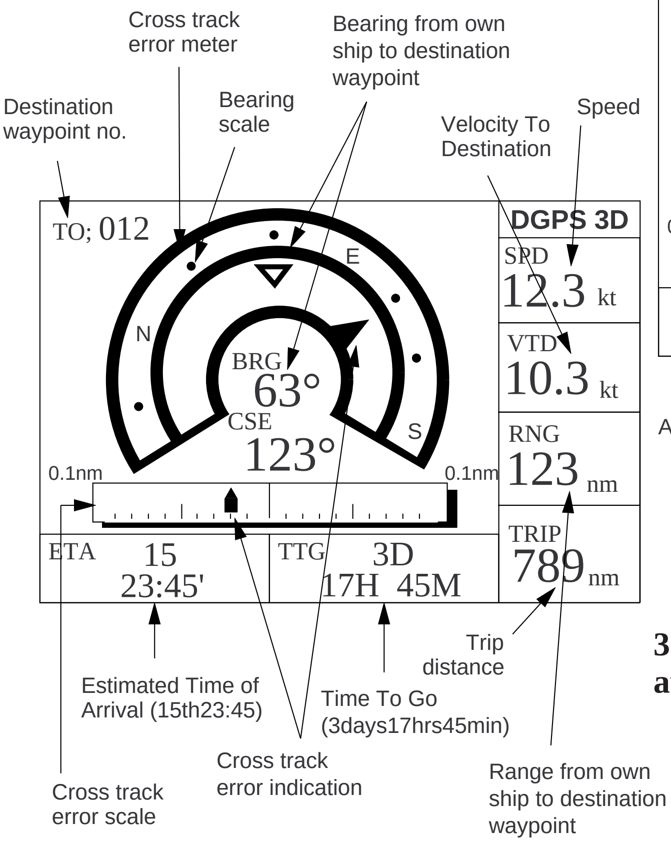


Figure 1-8 Navigation display, no autopilot connection

2) Autopilot connection, automatic mode

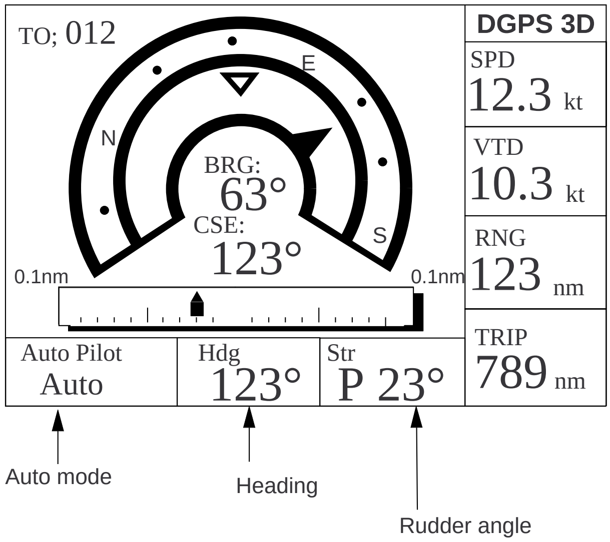


Figure 1-9 Navigation display, with autopilot connection, automatic mode

3) Autopilot connection, modes other than automatic mode (manual, nav, etc.)

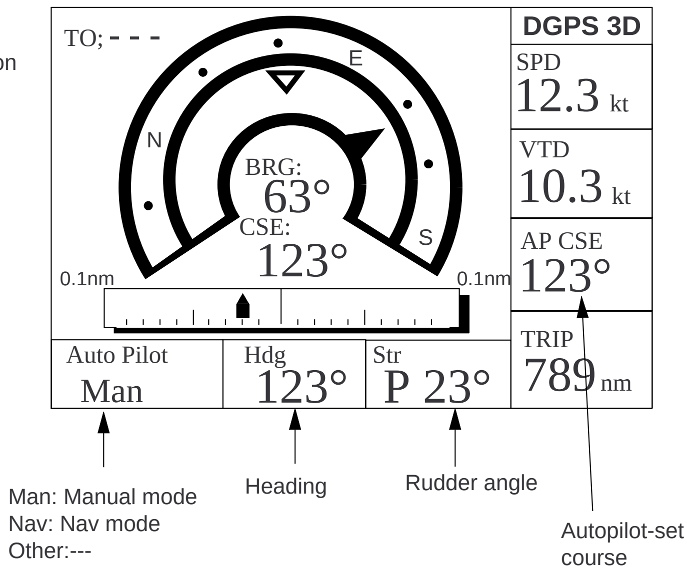


Figure 1-10 Navigation display, with autopilot connection, modes other than the automatic mode

Data display

Data to display and size of characters can be selected by the operator.

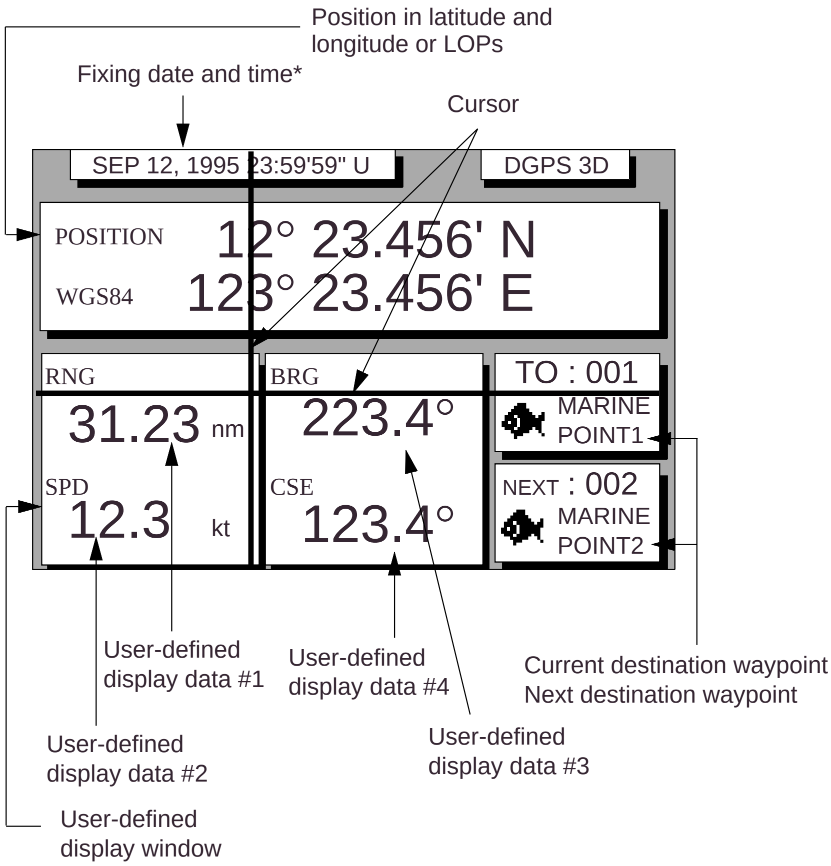


Figure 1-11 Data display mode

*: "--" appears until calculating position after turning on the power. If fixing error occurs this indication stops.

1.5 Transmitting Data

The GPS navigators share the data listed below when transmitting data to each other. Any action initiated against those data is automatically repeated on the other navigator. For example, if you register waypoint 27 on one navigator it will be registered on the other navigator under the same waypoint number.

- Alarm settings, alarm buzzer
- Destination data
- Disabled satellite data
- Error messages
- MOB/Event mark data
- Route data
- Waypoint data

Transmitting data

To mutually transmit data, do the following:

1) Press the [MENU ESC] key to display the MAIN menu.

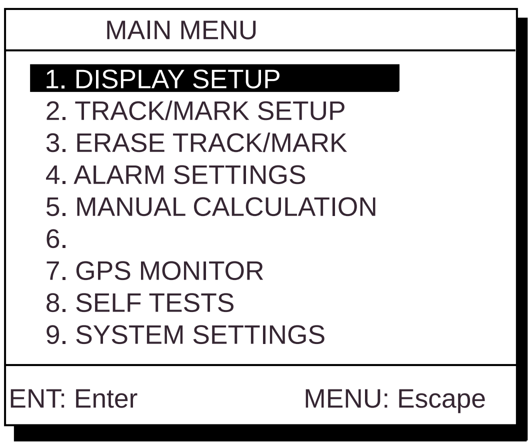


Figure 1-12 MAIN menu

2) Press the [9] key to display the SYSTEM SETTINGS menu.

```
SYSTEM SETTINGS
 1. PLOTTER SETUP
 2. UNIT SETUP
 3. DATA 1, 3 OUTPUT SETUP
 4. DATA TRANSFER
 5. DATA 4 I/O SETUP
 6. GPS SETUP
 7. DGPS SETUP
 8. LOP SETUP
 9. CLEAR MEMORY

ENT: Enter          MENU: Escape
```

Figure 1-13 SYSTEM SETTINGS menu

3) Press the [4] key to select DATA TRANSFER.

```
DATA TRANSFER
 Transmit Data
     All        Stop        Start

▲▼▶◀ : Select
ENT: Enter              MENU: Escape
```

Figure 1-14 DATA TRANSFER menu

4) Press ▶ to select All and press the [NU/CU ENT] key. The following message appears. Press the [NU/CU ENT] key to transmit, or [MENU ESC] to escape.

```
Are you sure to transmit ?

ENT: Yes          MENU: No
```

Figure 1-15

The following message appears while data is being transmitted.

```
Now transmitting data

MENU: Stop
```

Figure 1-16

5) To stop transmitting data, press the [MENU ESC] key. The following display appears.

```
Are you sure to stop ?

ENT: Yes          MENU: No
```

Figure 1-17

Press the [NU/CU ENT] key to stop. In this case, data is partially transmitted to the other GPS navigator. You should follow "Transmsitting data" in this paragraph to transmit data again.

6) The following message appears when data was transmitted successfully.

```
Transmitting ended
          successfully

Press any key
```

Figure 1-18

7) Press any key to escape.

8) If transmission failed, transmission is stopped and the following message appears.

```
Failed in transmitting
Try again please
Press any key
```

Figure 1-19

9) Press any key to return to the DATA TRANSFER menu and select Stop. Since data will be not the same on both GPS navigator, repeat this procedure from step 4 until data is successfully transmitted.

Transmission failure during operation

Data is transmitted only once. When transmission error occurs, the following message appears.

```
Failed in transmitting
Try "DATA TRANSFER" menu
Press any key
```

Figure 1-20

Press any key to erase the message. Follow "Transmitting data" in this paragraph to transmit data again.

1.6 The Interface Unit

The Interface Unit IF-2500 outputs data received from the navigators to external equipment. Operational status is shown by the LEDs on the unit. For further details, see APPENDIX B of this manual. For how to select data to output, see paragraph 8.4 Outputting Data.

Output data conventions

Since both navigators output data to the IF-2500 (through two ports on the interface) confusion would reign if it were to try to output two sets of mostly identical data. Therefore, data output is governed by the following rules:

- When both navigators are outputting data correctly, data received at the port having higher priority is output.
- When the GPS abnormal receive signal is received at the port having higher priority, data received from the other port is output.
  - 30 seconds after data received at the port having higher priority becomes normal, the interface resumes outputting data received from that port.
  - When data from both navigators is in error, data received at the port having higher priority is output.
- Arrival alarm signal or cross track error alarm is converted to a contact signal and output when received at the port having higher priority.
- When no data is received from one or both navigators, a contact signal is output.

2. DISPLAY AND TRACK

2.1 Enlarging/Shrinking the Display

You may enlarge/shrink the display on the Plotter 1 and Plotter 2 displays, with the [ZOOM IN] and [ZOOM OUT] keys. The horizontal range is available among 0.25, 0.5, 1, 2, 4, 8, 16, 32, 64, 128 and 192 nautical miles. For the Plotter 1 display the ranges are 0.36, 0.71, 1.42, 2.84, 5.69, 11.38, 22.76, 45.51, 91.02, 182.04 and 273.07 nautical miles.

The [ZOOM IN] key enlarges the display and the [ZOOM OUT] key shrinks it. Each time a zoom key is pressed the horizontal range appears at the center of the display for about three seconds.

2.2 Display Orientation

Display orientation can be selected on the Plotter 1, Plotter 2 and Highway displays, with the [NU/CU ENT] key. Two display orientations are available: north-up and course-up.

North-up display

In the north-up display, true north (0°) is at the top of the display. Own ship moves on the display in accordance with true speed and true motion. Land is stationary.

Course-up display

Destination set

The destination is at the top of the display and the north mark (Ⓐ) appears at the left side of the display.

Destination not set

Ship's heading or course is at the top of the display. The north mark appears at the left side of the display.

2.3 The Cursor

The cursor (+) functions to measure the select location for a mark; erase marks, measure range and bearing, etc.

Data and cursor state

Cursor state determines what data are shown on the display.

Cursor turned on

Cursor position is displayed in latitude and longitude or LOPs (depending on menu setting) at the top of the display. The range and bearing from own ship to the cursor appear at the right hand side of the display, when in the Plotter 1 display.

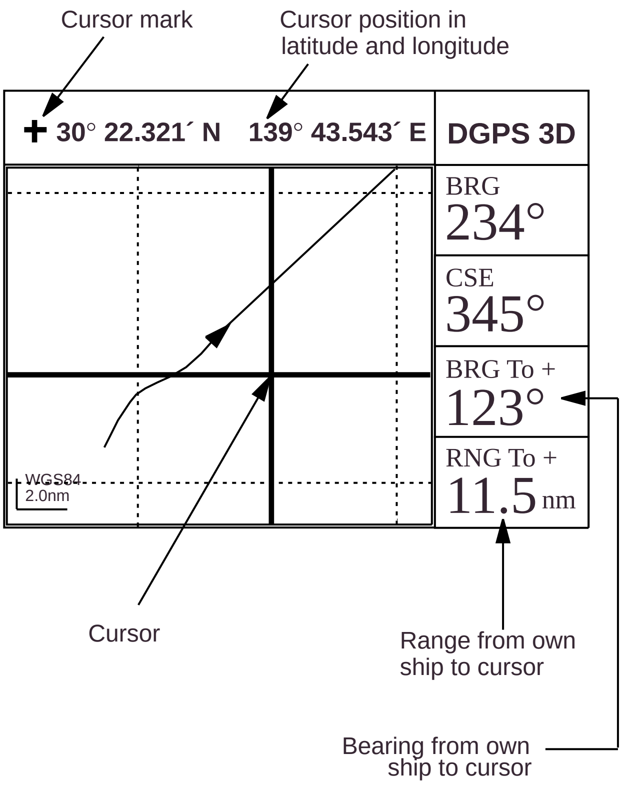


Figure 2-1 Data displayed when the cursor is on

Cursor turned off

Ship's position (in latitude and longitude or LOPs), speed and course appear on the display.

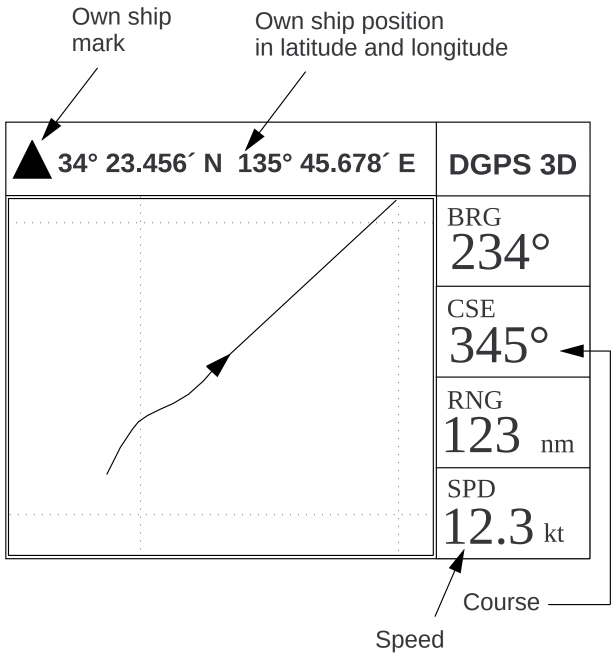


Figure 2-2 Data displayed when the cursor is turned off

Shifting the cursor

1) Press the [CURSOR ON/OFF] key to turn on the cursor.
2) Press the cursor keys to shift the cursor. The cursor moves in the direction of the cursor key arrow pressed. When the cursor reaches the edge of the display, the display shifts in the direction opposite of the cursor key pressed.

Centering the cursor

Press the [CENTER] key.

2.4 Shifting the Display

The display can be shifted on the Plotter 1 and Plotter 2 displays, with the [CURSOR ON/OFF] key. When own ship tracks off the display it is automatically returned to the screen center.

1) Press the [CURSOR ON/OFF] key to turn off the cursor.
2) Press the cursor keys. The display shifts in the direction of the cursor key pressed.

2.5 Centering Own Ship's Position

1) Press the [CURSOR ON/OFF] key to turn off the cursor.
2) Press the [CENTER] key.

2.6 Stopping/Starting Plotting and Recording of Track

The DD-80 stores 2,000 points of track and marks. When the memory becomes full the oldest track is erased to make room for the latest. Thus you may want to conserve the memory when, for example, you are returning to port or are anchored, by stopping plotting and recording of the track.

Procedure

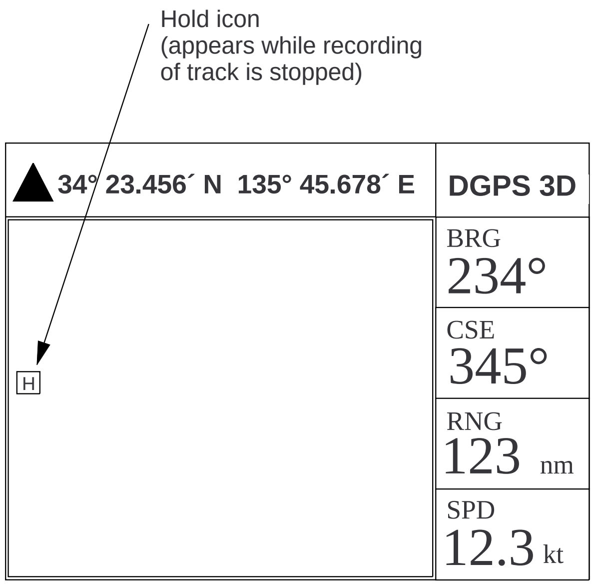
Press the [PLOT ON/OFF] key to start/stop recording and plotting of track.

When plotting is resumed

"Resuming track plot" appears at the center of the display for about three seconds.

When plotting is stopped

"Stopping track plot" appears at the center of the display for about three seconds and "H" appears at the left side of the display. ("H" does not appear on the Navigation and Data displays.)



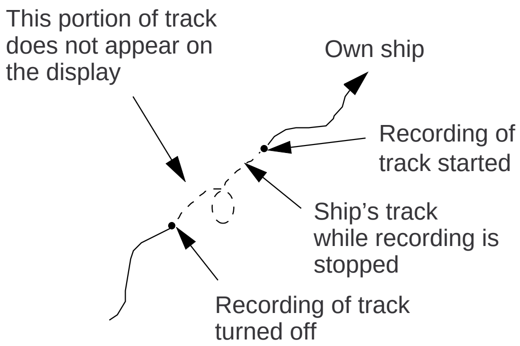


Figure 2-3 Track not plotted or recorded when plotting is stopped

2.7 Erasing Track

The track stored in the memory and displayed on the screen can be erased.

Note: Track cannot be restored once erased. Be absolutely sure you want to erase track.

1) Press the [MENU ESC] key. The MAIN MENU appears.

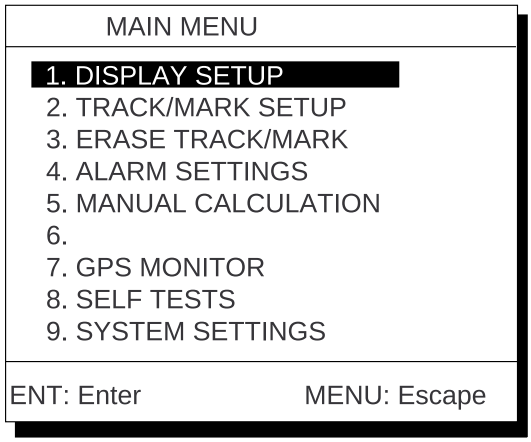


Figure 2-4 MAIN menu

2) Press [3] to select ERASE TRACK/ MARK.

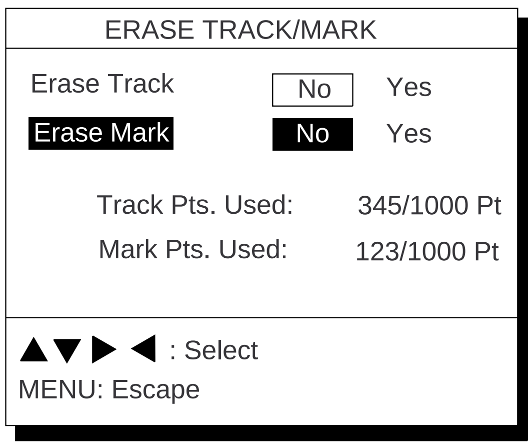


Figure 2-5 ERASE TRACK/MARK menu

3) Press ▲ or ▼ to select Erase Track.

4) Press ▶ to select Yes. The message shown in Figure 2-6 appears.

Are you sure to erase ?

ENT: Yes MENU: No

Figure 2-6 Prompt for erasure of track, mark

5) Press the [NU/CU ENT] key.

2.8 Track Plotting Interval

The plotting interval determines both how the track will be reconstructed on the display and track storage time. A shorter interval provides more accurate reconstruction of track line, however total storage time is reduced. The plotting interval can be selected by time or distance. Plotting by distance offers the advantage that the track is not stored when the vessel is anchored.

Plotting interval by time

The setting range for plotting by time is 00 to 60 minutes.

1) Press the [MENU ESC] key.
2) Press [2] to display the TRACK/MARK SETUP menu.

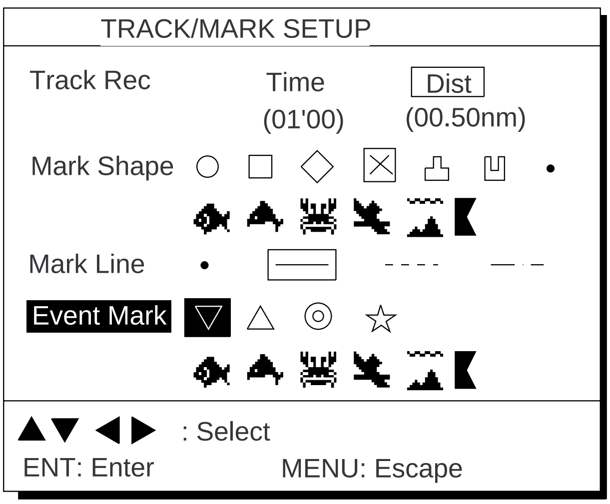


Figure 2-7 TRACK/MARK SETUP menu

3) Press ▲ or ▼ to select Track Rec.
4) Press ◀ to select Time.
5) Enter plotting interval in four digits. To enter 30 seconds, for example, press [0] [0] [3] [0].
6) Press the [NU/CU ENT] key.
7) Press the [MENU ESC] key.

Plotting interval by distance

The setting range for plotting by distance is 0.01 to 99.99 nautical miles. To plot all track, enter 00.00.

1) Press the [MENU ESC] key.
2) Press [2] to display the TRACK/MARK SETUP menu.
3) Press ▲ or ▼ to select Track Rec.
4) Press ▶ to select Distance.
5) Enter plotting interval. To enter 0.1 nautical miles, for example, press [0] [0] [1].
6) Press the [NU/CU ENT] key.
7) Press the [MENU ESC] key.

2.9 Apportioning the Memory

The memory holds 2,000 points of track and marks and may be apportioned as you like. The default memory setting stores 1,000 points each of track and marks.

Note: All data are erased when the memory apportion setting is changed, even when the previous value is reentered.

To store 1,500 points of track and 500 marks, for example, do the following:

1) Press the [MENU ESC] key.
2) Press [9] to display the SYSTEM SETTINGS menu.

SYSTEM SETTINGS

1. PLOTTER SETUP
2. UNIT SETUP
3. DATA 1, 3 OUTPUT SETUP
4. DATA TRANSFER
5. DATA 4 I/O SETUP
6. GPS SETUP
7. DGPS SETUP
8. LOP SETUP
9. CLEAR MEMORY

ENT: Enter MENU: Escape

Figure 2-8 SYSTEM SETTNGS menu

3) Press [1] to display the PLOTTER SETUP menu.

PLOTTER SETUP

Memory Apportion	Trk = 1000 / 2000Pt	
Bearing Ref.	True	Mag
Mag Variation	Auto (07° W)	Man (00° E)
Calculation	R.L	G.C
User defined #1	◀ RNG ▶	
#2	◀ SPD ▶	
#3	◀ BRG ▶	
#4	◀ CSE ▶	

ENT: Enter MENU: Escape

Figure 2-9 PLOTTER SETUP menu

4) Press ▲ or ▼ to select Memory Apportion.
5) Enter amount of track to store, in four digits. To store 1,500 track points, for example, press [1] [5] [0] [0].
6) Press the [NU/CU ENT] key, or ▲ or ▼. You are asked if it is all right to erase all data.

Setting erases all data!
Are you sure to change ?

ENT: Yes MENU: No

Figure 2-10

7) Press the [NU/CU ENT] key.
8) Press the [MENU ESC] key.

2.10 Bearing Reference

Ship's course and bearing to waypoint may be displayed in true or magnetic bearing. Magnetic bearing is true bearing plus (or minus) earth's magnetic deviation.

True or magnetic bearing

The default setting displays magnetic bearings.

1) Press the [MENU ESC] key.
2) Press [9] to display the SYSTEM SETTINGS menu.
3) Press [1] to display the PLOTTER SETUP menu.
4) Press ▲ or ▼ to select Bearing Ref.
5) Press ◀ or ▶ to select True or Mag.
6) Press the [NU/CU ENT] key, ▲ or ▼.
7) Press the [MENU ESC] key.

Magnetic variation

The location of the magnetic north pole is different from the geographical north pole. This causes a difference between the true and magnetic north direction. This difference is called magnetic variation, and varies with respect to the observation point on the earth. Magnetic variation may be entered automatically or manually.

1) Press the [MENU ESC] key.
2) Press [9] to display the SYSTEM SETTINGS menu.
3) Press [1] to display the PLOTTER SETUP menu.
4) Press ▲ or ▼ to select Mag Variation.
5) Press ◀ or ▶ to select Auto or Man. For automatic, current variation appears in parentheses.
6) **For manual entry,** enter variation in two digits, referring to a nautical chart. If the variation is 10°, for example, press [1] [0].
7) If necessary, press the [⟳] key to change coordinate from east to west or vice versa.
8) Press the [NU/CU ENT] key.
9) Press the [MENU ESC] key.

3. MARKS

3.1 Entering Marks

Marks can be inscribed on the Plotter 1 and Plotter 2 displays, in one of 12 mark shapes. Further, marks can be connected with lines to denote net location, etc.

Note 1: When the mark memory becomes full no marks can be entered. When this occurs, the buzzer sounds and the message shown below appears on the display for three seconds. To enter a mark when the mark memory is full, erase unnecessary marks.

Can't save mark
Memory full

Figure 3-1

Note 2: Marks cannot be entered when there is no position data. When this occurs, the buzzer sounds and the message shown below appears on the display for three seconds to alert you. Check the antenna cable for tight connection.

Can't save mark
No position data

Figure 3-2

Entering marks

At own ship position

1) Press the [CURSOR ON/OFF] key to turn off the cursor.
2) Press the [MARK] key.

At cursor intersection

1) Press the [CURSOR ON/OFF] key to turn on the cursor.
2) Operate the cursor keys to place the cursor on the location for the mark.
3) Press the [MARK] key.

3.2 Erasing Marks

Marks can be erased individually or collectively.

Note: All marks, including event marks and the MOB mark, can be erased on the ERASE MARK menu. Be absolutely sure you want to erase all marks; erased marks cannot be restored.

Erasing individual marks

1) Place cursor on the mark to erase.
2) Press the [CLEAR] key.

Erasing all marks

1) Press [MENU ESC] and [3] to display the ERASE TRACK/MARK menu.

ERASE TRACK/MARK

Erase Track	No	Yes
Erase Mark	No	Yes
Track Pts. Used:	345/1000 Pt	
Mark Pts. Used:	123/1000 Pt	

▲▼▶◀ : Select
MENU: Escape

Figure 3-3 ERASE TRACK/MARK menu

2) Press ▲ or ▼ to select Erase Mark.
3) Press ▶ to select YES.

Are you sure to erase ?

ENT: Yes MENU: No

Figure 3-4

4) Press the [NU/CU ENT] key.

5) Press the [MENU ESC] key.

3.3 Mark Shape

12 mark shapes are available. Select mark shape as follows:

1) Press [MENU ESC] and [2] to display the TRACK/MARK SETUP menu.

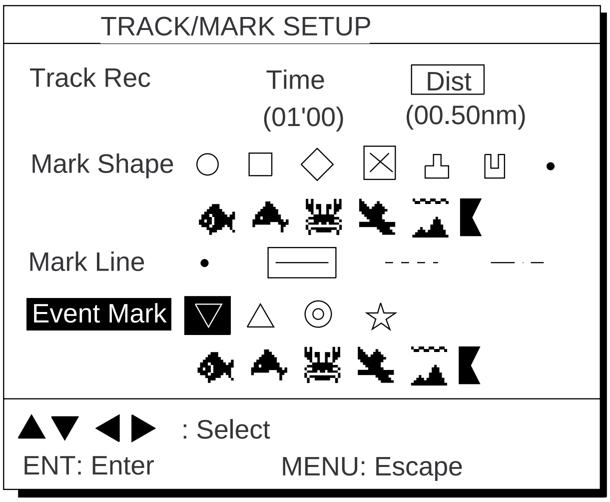


Figure 3-5 TRACK/MARK SETUP menu

2) Press ▲ or ▼ to select Mark Shape.

3) Press ◀ or ▶ to select mark shape desired.

4) Press the [NU/CU ENT] key.

5) Press the [MENU ESC] key.

The next mark entered will be inscribed in the shape selected here.

3.4 Connecting Marks

Marks can be connected with lines to denote net location, fishing spot, etc. Three types of connection lines are available and the "•" setting disables connection of lines.

1) Press [MENU ESC] and [2]

2) Press ▲ or ▼ to select Mark Line.

3) Press ◀ or ▶ to select mark line desired.

4) Press the [NU/CU ENT] key.

5) Press the [MENU ESC] key.

3.5 Entering Event Marks

Event marks can denote any important present position; for example, a good fishing spot. 99 event marks can be saved, and the unit automatically numbers them from 01 to 99.

Event marks are mutually entered when the navigators are sharing data.

Note 1: When the mark memory becomes full no event marks can be entered. When this occurs, the buzzer sounds and the message shown below appears on the display for three seconds to alert you. To enter an event mark when the mark memory is full, erase unnecessary event marks.

Can't save event
Memory full

Figure 3-6

Note 2: Event marks cannot be entered when there is no position data. When this occurs, the buzzer sounds and the message shown below appears on the display for three seconds to alert you. Check the antenna cable for tight connection.

Can't save event/MOB
No position data

Figure 3-7

To enter an event mark;

1) Press the [EVENT MOB] key less than three seconds. The position at the exact moment the key is pressed is saved as an event position.

Saved event position

34°40.123' N
135°21.123' E

Figure 3-8

To erase event marks, see "3.2 Erasing Marks".

3.6 Event Mark Shape

Event marks are available in 9 shapes.

Event mark shape is mutually changed when the navigators are sharing data.

Select event mark shape as follows.

1) Press [MENU ESC] and [2] to display the TRACK/MARK SETUP menu.
2) Press ▲ or ▼ to select Event Mark.
3) Press ◀ or ▶ to select event mark shape desired.
4) Press the [NU/CU ENT] key.
5) Press the [MENU ESC] key.

The next event mark entered will be inscribed in the shape selected here.

3.7 Entering the MOB Mark

The MOB mark denotes man overboard position. To mark man overboard position, press the [EVENT MOB] key. When the key is pressed, the position at the exact moment the key is pressed automatically becomes the destination. Further, the Plotter 1 display replaces the display in use when it is other than a plotter display.

Only one MOB mark may be entered. Each time the MOB mark is entered the previous MOB mark and its position data are written over. The MOB mark is mutually entered when the navigators are sharing data.

Note: The MOB mark cannot be entered when there is no position data. When this occurs, the buzzer sounds and the message shown below appears on the display for three seconds to alert you. Check the antenna cable for tight connection.

Can't save event/MOB
No position data

Figure 3-9

1) Press the [EVENT MOB] key for at least three seconds.

   The MOB mark ("M") is entered at the MOB position and the message shown in Figure 3-10 appears.

Saved MOB position
Are you sure to change course
to MOB position ?
ENT: Yes MENU: No

Figure 3-10

2) Press the [NU/CU ENT] key. If the display in use is Highway, Navigation or Data, they are automatically replaced by the Plotter 1 display.

Note: You may cancel MOB position as destination by pressing the [MENU ESC] key instead of the [NU/CU ENT] key at step 2. Note that the MOB mark remains on the display.

Erasing the MOB mark

See "3.2 Erasing Marks". (MOB marks cannot be erased with the cursor.) The MOB mark is mutually erased when the navigators are sharing data.

4. NAVIGATION PLANNING

4.1 Entering Waypoints

In navigation terminology a waypoint is a particular location on a voyage whether it be a starting, intermediate or destination waypoint.

The DD-80 can store 999 waypoints, numbered from 001–999. Waypoints can be registered four ways:

- by cursor
- by MOB position or event position
- at own ship's position, and
- through the waypoint list.

Waypoints are mutually entered when the navigators are sharing data.

Entering waypoints by the cursor

1) Press the [WPT RTE] key. The Waypoint/Route menu appears.

```
Waypoint/Route
  1. Cursor
  2. MOB/Event Position
  3. Own ship Position
  4. Waypoint List
  5. Route Planning

▲▼ : Cursor
ENT: Enter          MENU: Escape
```

Figure 4-1 Waypoint/Route menu

2) Press [1] to select Cursor. The following display appears.

```
Place cursor on desired location

ENT: Enter       MENU: Escape
```

Figure 4-2

The display changes to Plotter 2 when the Highway, Navigation or Data mode is in use.

3) Press the cursor keys to place the cursor on the location desired for the waypoint.

4) Press the [NU/CU ENT] key.

A window similar to the one shown in Figure 4-3 appears. The waypoint's position and date and time registered appear on the first and second lines. Waypoints are automatically given the youngest empty waypoint number and this number appears on the third line. You may, however, assign a different number. If the waypoint shares the same position with a mark, the mark's position and date and time entered are registered as waypoint data.

If the waypoint memory is full, the waypoint number line in the window is blank. In this case waypoints cannot be entered unless a waypoint is written over or erased.

To assign waypoint number, go to step 5. If you do not want to change the waypoint number, go to step 6 to select mark shape and enter comment.

```
30° 12.345' N  135° 23.456' W
          AUG 12' 95  12 : 34U
 No.  :  123
 Mark :  ____
 Cmnt : _ _ _ _ _ _ _ _ _ _ _ _ _ _

◀ ▶ : Cursor     ▼ : Column
ENT: Enter       MENU: Escape
```

Figure 4-3

5) Enter waypoint number, in three digits (001–999).

6) Press ▼ to select waypoint mark shape.

6) Press ▼ to select waypoint mark shape. The following display appears.



Figure 4-4 Screen for selecting waypoint mark shape

7) Press ◀ or ▶ to select mark shape.

8) Press the [NU/CU ENT] key. The display shown in Figure 4-5 appears.

```
ABCDE FGHIJ KLMNO PQRST UVWXYZ
abcde  fghij  klmno  pqrst  uvwxyz
1 2 3 4 5 6 7 8 9 0 _ # % ' ( ) + - . / : ; < = > ?
ENTER
COMMENT: _ _ _ _ _ _ _ _ _ _ _ _
◀ ▶ : Cursor
ENT: Set          MENU: Escape
```

Figure 4-5 Screen for entry of comment for waypoint

9) You may enter a comment, as shown in the procedure which follows, or skip to step 10 to finish. The comment may consist of up to 12 alphanumeric characters.

① Press the cursor keys to select alphanumeric character.

② Press the [NU/CU ENT] key. Selected character appears on the COMMENT line.

- To create a space, select "_".
- Numeric data can be input directly by pressing numeric keys.
- To clear wrong data, press the [CLEAR] key.

③ Repeat steps 1 and 2 to complete the comment.

④ Select ENTER and press the [NU/CU ENT] key.

10) Press the [NU/CU ENT] key.

Control is returned to the last used display mode.

When the waypoint number entered at step 5 already exists, the message shown in Figure 4-4 appears if the waypoint is part of the current destination or route or is part of a route. If it is you are sure to write over the waypoint and its data, press the [Y] key. To change waypoint number, press the [N] key.

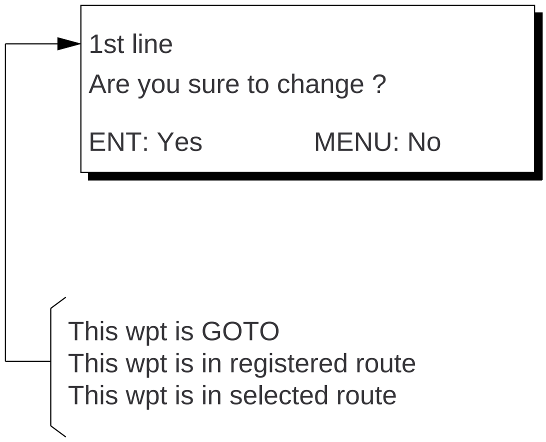


Figure 4-6

Note: If you fail to enter waypoint number, "Enter waypoint number" appears on the display for three seconds.

Entering waypoints by MOB position/event position

The MOB position or an event position can be registered as a waypoint. Event marks are numbered from 01 to 99; 01 is the latest event mark.

Note: You cannot register a MOB position or event position when there are no MOB positions or event positions saved. The buzzer sounds and the message shown in Figure 4-7 appears for three seconds to alert you.

No MOB/event data in memory

Figure 4-7

1) Press the [WPT/RTE] key.
2) Press [2] to select MOB/Event Position. The display shown in Figure 4-8 appears.

[MOB] Displaying MOB data
34° 12.345' N 130° 23.456' E

[#01] Displaying event data
34° 12.345' N 130° 23.456' E
AUG 12' 95 19 : 25U
: Paging
ENT: Enter MENU: Escape

Figure 4-8

3) Press or to display the MOB position or event position to register as a waypoint.
4) Press the [NU/CU ENT] key.
5) Follow steps 5 through 11 in "Entering waypoints by the cursor" on page 4-1.

Entering waypoints at own ship's position

Note: When there is no position data, you cannot register a waypoint at own ship's position. The buzzer sounds and the following message appears.

No position data

Figure 4-9

1) Press the [WPT/RTE] key.
2) Press [3] to select Own Ship Position.
3) Follow steps 5 through 11 in "Entering waypoints by the cursor" on page 4-1.

Entering waypoints through the waypoint list

1) Press the [WPT/RTE] key.
2) Press [4] to display the waypoint list.
3) Press [ ] to select position format; latitude and longitude or LOP.

WAYPOINT LIST (L/L)
001 34° 12.345' N 130° 23.456' W
MARINE POINT AUG 12' 95 12 : 35U
002 36° 12.345' N 135° 23.456' W
___ A POINT AUG 13' 95 13 : 45U
003 __ °__.__' N ___° __.__' W
___ ____________
004 __ °__.__' N ___° __.__' W
___ ____________
: L/L´LOP : Edit
ENT: Enter MENU: Escape

Figure 4-10

4) Press ▲ or ▼ to select waypoint number.
5) Press or to enter position. The display should now look something like Figure 4-11.

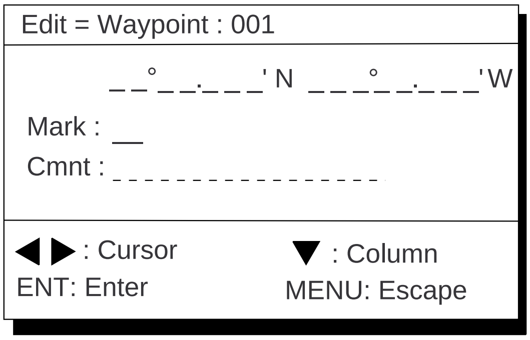


Figure 4-11

6) Enter latitude and longitude. To enter 34°12.345' N 135°23.456' E, for example, press;

([⟳]) [3] [4] [1] [2] [3] [4] [5]

([⟳]) [1] [3] [5] [2] [3] [4] [5] [6]

To change N to S or E to W, press [⟳].

7) Press ▼.

8) Press ◀ or ▶ to select mark.

9) Press the [NU/CU ENT] key.

10) Enter comment.

11) Press the [NU/CU ENT] key twice.

The waypoint list reappears. Waypoint position and date and time the waypoint was entered appear on the list.

12) To enter another waypoint through the waypoint list, return to step 4.

13) Press the [MENU ESC] key to finish.

4.2 Editing Waypoints

Waypoints are mutually edited when the navigators are sharing data.

1) Press [WPT RTE] and [4].

2) Press ▲ or ▼ to select waypoint to edit.

3) Press ▶.

4) Edit the contents of the waypoint.

5) Press the [NU/CU ENT] key. The message shown in Figure 4-12 appears if the waypoint is currently selected as destination, is part of a route, or is in the route currently selected as destination.

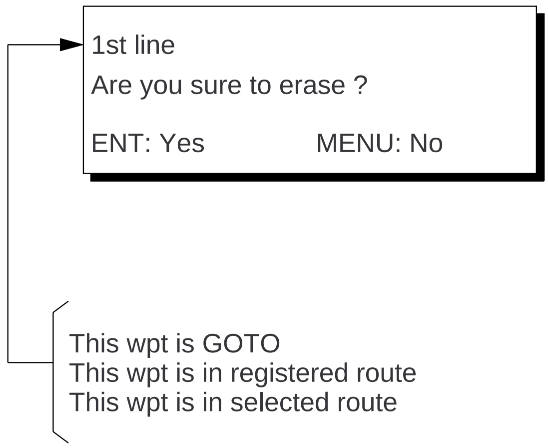


Figure 4-12

6) Press the [NU/CU ENT] key.

The waypoint and its data are erased. Enter new data, referring to "4.1 Entering Waypoints".

7) Press the [MENU ESC] key.

4.3 Erasing Waypoints

Waypoints are mutually erased when the navigators are sharing data.

Erasing waypoints by the cursor

1) Place the cursor on the waypoint to erase.

2) Press the [CLEAR] key.

Erasing waypoints through the waypoint list

1) Press [WPT RTE] and [4].
2) Press ▲ or ▼ to select waypoint to erase.
3) Press the [CLEAR] key. The message shown in Figure 4-13 appears if the waypoint is currently selected as destination, is part of a route, or is in the route currently selected as destination.

1st line
Are you sure to erase ?
ENT: Yes MENU: No

This wpt is GOTO
This wpt is in registered route
This wpt is in selected route

Figure 4-13

Note: All waypoint marks (as well as all other marks) and their data can be erased collectively by clearing the Plotter memory. For further details, see page 9-1.

4) Press the [NU/CU ENT] key.

Note: To cancel erasure, press the [MENU ESC] key instead of the [NU/CU ENT] key. The waypoint list appears.

5) Press the [MENU ESC] key.

4.4 Entering Routes

Often a trip from one place to another involves several course changes, requiring a series of route points which you navigate to, one after another. The sequence of waypoints leading to the ultimate destination is called a route. The DD-80 can automatically advance to the next waypoint on a route, so you do not have to change the destination waypoint repeatedly.

The DD-80 can store 30 routes and each route may contain up to 30 waypoints. Routes can be registered while in the Plotter 1 or Plotter 2 display mode. Routes are mutually registered when the navigators are sharing data.

Entering routes

1) Press the [WPT/RTE] key.
2) Press [5] to select Route Planning. The route list appears.

ROUTE LIST

No.	PTS	Total Dist.	TTG	Remarks
01	30	1234 . 56 nm	12D15H28M	UseFwd
02	25	234 . 56 nm	2D08H35M	
03	30	*999. 99 nm	*9D*9H*9M	
04	_ _	_____ . __ nm	__D__H__M	
05	30	6543 . 21 nm	34D23H45M	
06	__	_____ . __ nm	__D__H__M	

▲▼ : Route No. ◀ ▶ : Edit
ENT: Enter MENU: Escape

Remarks
Use: In use
Fwd: Traverse waypoints in forward order
Rvs: Traverse waypoints in reverse order

Figure 4-14 Route list

3) Press ▲ or ▼ to select route number.
4) Press ▶.

The route planning/waypoint list window appear as shown in Figure 4-15. The waypoint list window lists the position and data for each registered waypoint. No position or data appears for empty waypoints.

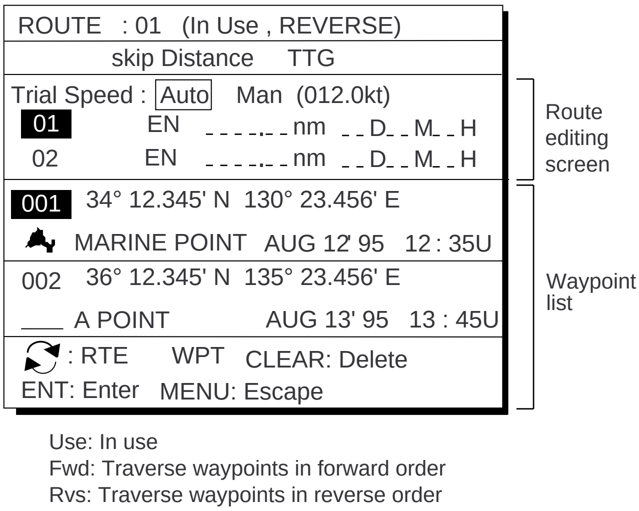


Figure 4-15 Route editing screen

5) If required, press ▲ to enter the speed by which to calculate time-to-go.

6) Press ◀ or ▶ to select Auto or Man.

   Auto: Current average speed is used to calculate the time-to-go. **Manual:** Entered speed is used to calculate the time-to-go. Enter speed and press ▼.

Route waypoints may be registered two ways: entering waypoint number directly or through the route editing screen. Follow ① or ② below.

① Entering waypoint number directly

7) Enter waypoint number, in three digits. The cursor shifts to the "Skip" window. The procedure for skipping a waypoint is shown on page 5-4. For now, go to the next step.

8) Press ▼ to continue. If the waypoint entered in step 7 does not exist, you are informed that the waypoint does not exist and entry is cancelled.

9) Enter other route waypoints by repeating steps 7 and 8.

10) Press [MENU ESC] to finish.

② Using previously registered waypoints

Enter waypoints in the order they will be traversed; not by waypoint number order.

7) Press [⟲]. The reverse video on the waypoint on route planing screen disappears.

8) Press ▲ or ▼ to select waypoint number.

9) Press the [NU/CU ENT] key. Selected waypoint number appears on the route editing screen. The distance and time-to-go indications to the first waypoint entered are blank.

10) To enter other route waypoints, repeat steps 8 and 9.

11) Press the [MENU ESC] key to finish.

Note: To return to the route editing screen, press [⟲].

4.5 Erasing Route Waypoints

Route waypoints are mutually erased when the navigators are sharing data.

1) Press [WPT RTE] and [5] to display the route list.
2) Press ▲ or ▼ to select route.
3) Press ▶ to display route editing screen.
4) Select the waypoint to erase.
5) Press the [CLEAR] key.
6) Press the [NU/CU ENT] key.
7) Repeat steps 2 through 4 to continue erasing waypoints.
8) Press the [MENU ESC] key. The route is rearranged to reflect the change.

4.6 Replacing Route Waypoints

Route waypoints are mutually replaced when the navigators are sharing data.

1) Press [WPT RTE] and [5] to display the route list.
2) Press ▲ or ▼ to select route.
3) Press ▶ to display route editing screen.
4) On the route editing screen, place the cursor on waypoint number to replace.
5) Enter new waypoint number.
6) Press the [NU/CU ENT] key. The message shown in Figure 4-16 appears.

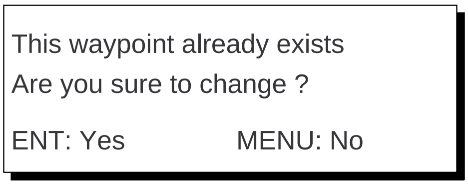


Figure 4-16

7) Press the [NU/CU ENT] key.
8) Press the [MENU ESC] key twice.

4.7 Erasing Routes

Routes are mutually erased when the navigators are sharing data.

1) Press [WPT RTE] and [5] to display the route list.
2) Press ▲ or ▼ to select route to erase.
3) Press the [CLEAR] key. The display shown in Figure 4-17 appears if the route is in use.

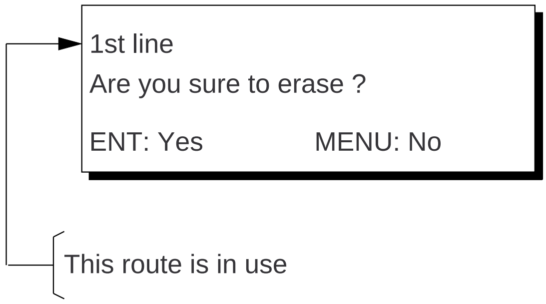


Figure 4-17

4) Press the [NU/CU ENT] key.
5) Press the [MENU ESC] key.

This page is intentionally left blank.

5. SETTING DESTINATION

5.1 Setting Destination

There are four ways by which you can set destination:

- By cursor
- By MOB position or event position
- By waypoint, and
- By route.

The same destination is set on both navigators when they are sharing data.

Note 1: Destination cannot be set when there is no GPS position data. When there is no position data, the buzzer sounds and the message shown in Figure 5-1 appears.

```
No position data
```

Figure 5-1

Note 2: Previous destination is cancelled whenever a destination is set.

Setting destination by cursor

Using the cursor you may set a destination consisting of 30 points. When all 30 points are entered, the DD-80 automatically disables further entry.

Setting single destination

1) Press the [GOTO] key. The menu shown in Figure 5-2 appears.

```
GOTO Setting

1. Cursor
2. MOB/Event Position
3. Waypoint List
4. Route List
5. Cancel

▲ ▼  : Cursor
ENT  : Enter     MENU : Escape
```

Figure 5-2 GOTO setting menu

2) Press [1] to select Cursor. The display shown in Figure 5-3 appears.

```
Place cursor on desired location
Press ENT twice to finish
ENT:Enter CLR:Clear MENU:Escape
```

Figure 5-3

If the display in use is other than Plotter 1, the Plotter 2 display is automatically selected.

3) Place the cursor on the location desired for destination.

4) Press the [NU/CU ENT] key.

Note: To clear selection, press the [CLEAR] key.

5) Press the [NU/CU ENT] key to finish.

Control is returned to the display mode in use before you set destination. A dashed line connects own ship and the destination, which is marked with a flag, as shown in Figure 5-4.

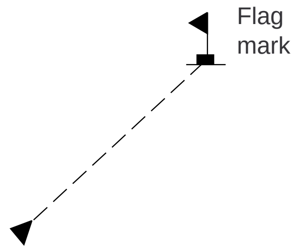


Figure 5-4 Single destination set by cursor

Setting multiple destinations

1) Press [GOTO] and [1].
2) Place the cursor on the location desired for waypoint.
3) Press the [NU/CU ENT] key.
4) Repeat steps 2 and 3 to enter other points. Waypoints are connected with a line.
5) Press the [NU/CU ENT] key to finish. The route number entry display appears as shown in Figure 5-5. If no route number appears or you want to change the route number shown, go to step 6 to enter route number. To register the route under the number shown, go to step 8.

```
  Enter route number
        01
ENT:Enter  MENU: Escape
```

Figure 5-5

6) Key in route number.
7) Press the [NU/CU ENT] key. Waypoints are marked with flags and are connected with a dashed line.

   If the route number entered already exists the message shown in Figure 5-6 appears.

```
Overwriting ?
ENT:Yes    MENU:No
```

Figure 5-6

8) Press the [NU/CU ENT] key.

The waypoints do not have waypoint numbers, however you can attach waypoint numbers by doing the following.

① Press [WPT RTE] and [5] to display the route list.

② Press ▲ or ▼ to select route number entered.

③ Press ▶.

④ Enter waypoint number, in three digits.

⑤ Press ▼. If the waypoint number already exists the message shown in Figure 5-7 appears.

```
This waypoint already exists
Are you sure to change ?
 ENT:Yes    MENU:No
```

Figure 5-7

⑥ Press the [NU/CU ENT] key. The waypoint entered here replaces previously entered waypoint.

   Note: To cancel replacement of waypoint, press the [MENU ESC] key at step ⑥.

⑦ Repeat steps ④ and ⑤ to enter other waypoint numbers.

⑧ Press the [MENU ESC] key twice to finish.

When destination is cancelled, dashed lines are erased but flags remain on the screen.

Setting destination by MOB position or event position

Note: This operation cannot be performed when there is no MOB position or event position. The buzzer sounds and the message shown in Figure 5-8 appears to alert you when there is no MOB position or event position.



Figure 5-8

1) Press the [GOTO] key.
2) Press [2] to select MOB/Event Position. The display shown in Figure 5-9 appears.

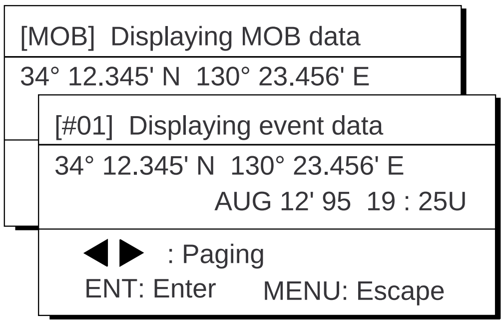


Figure 5-9

3) Press ◀ or ▶ to select MOB position or event position. The MOB position appears first. To select event position, press ▶. If selected position is within the current display range, the cursor marks the position. (The cursor does not appear on the Highway, Navigation and Data displays.)
4) Press the [NU/CU ENT] key. A flag appears at position selected if it is within the current display range. A dashed line connects between own ship and MOB position or event position.

When destination is cancelled, dashed lines are erased but flags remain on the screen.

Setting destination through waypoint list

Note: A waypoint must exist to set it as destination. When a waypoint does not exist, the buzzer sounds and the message shown in Figure 5-10 appears.



Figure 5-10

Destination waypoint can be set through the waypoint list two ways:

- By entering waypoint number, and
- By selecting waypoint by cursor

1) Press the [GOTO] key.
2) Press [3] to display the Waypoint List.

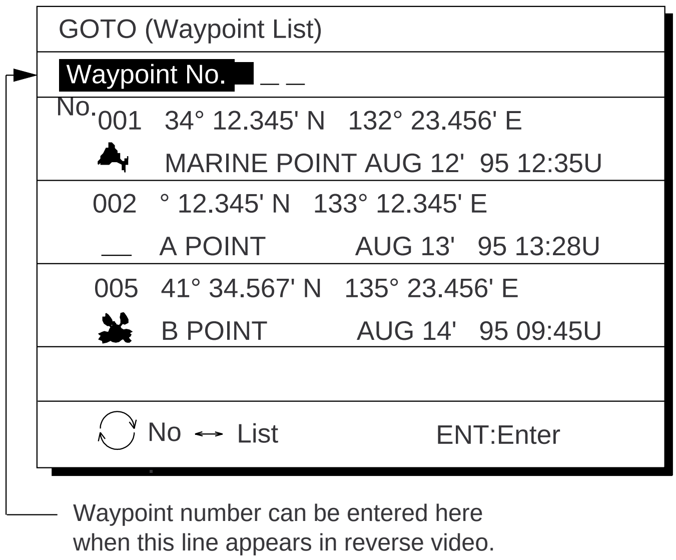


Figure 5-11 Waypoint list

Set destination by following ① or ② below.

① Setting destination by waypoint no.

3) Enter waypoint number, in three digits. You can clear entry by pressing the [CLEAR] key.
4) Press the [NU/CU ENT] key.

Own ship position becomes starting point and a dashed line runs between it and the waypoint selected.

② Setting destination by selecting wpt.

3) Press [⟳]. Each press of the key alternately enables manual entry of waypoint number and selection of waypoint number by cursor (through the waypoint window).

4) Press ▲ or ▼ to select waypoint.

5) Press the [NU/CU ENT] key.

Own ship position becomes starting point and a dashed line runs between it and the waypoint selected.

Setting route as destination

Note: Route entered must exist to set it as destination. The buzzer sounds and the message shown in Figure 5-12 appears if you set enter a route which does not exist.

No route data

Figure 5-12

A route to set as destination may selected through the route list two ways:

- By entering route number, and
- By selecting route.

1) Press the [GOTO] key.

2) Press [4] to display the Route List. Then, follow ① or ② in the adjacent column.

Route number can be entered here when this line appears in reverse video.

GOTO (Route List) ◀FORWARD▶

Route No. █_

No.	PTS	TOTAL	TTG
01	30	1234. 56nm	12D15H28M
02	25	234. 56nm	2D08H35M
05	8	57. 89nm	0D10H28M
06	30	*999. 99nm	*9D23H59M
10	30	6543. 21nm	34D23H45M

⟳ : No. ↔ List

ENT:Enter MENU:Escape

Figure 5-13 Route list

① By entering route number

3) Press ◀ or ▶ to select direction which to traverse the route waypoints; forward or reverse.

4) Enter route number.

5) Press the [NU/CU ENT] key.

Current position becomes starting point. A solid line connects between the starting point and first route waypoint and a dashed line connects all other route waypoints.

② By selecting a route

3) Press [⟳]. Each press of the key alternately enables manual entry of route number and selection of route number (through the route window)

4) Press ▲ or ▼ to select route.

5) Press ◀ or ▶ to select direction in which to traverse the route waypoints; forward or reverse.

6) Press the [NU/CU ENT] key.

Current position becomes starting point. A solid line connects between the starting point and first route waypoint and a dashed line connects all other route waypoints.

Skipping route waypoints

You may skip route waypoints by displaying "DI" (DIsable) next to the route waypoint in the route list. Using Figure 5-14 as an example, your ship is currently heading toward waypoint 04 but is to switch course and head to waypoint 03. In this case you would want to skip waypoint 04.

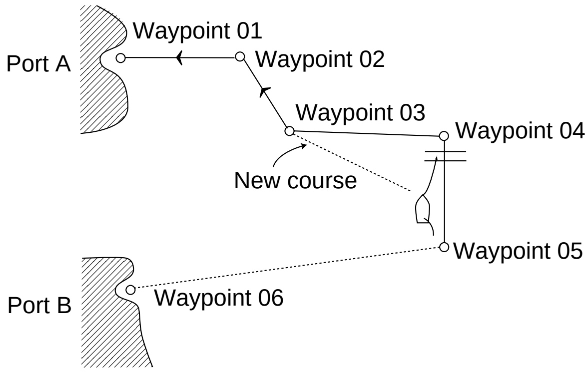


Figure 5-14

1) Press [WPT RTE] and [5] to display the route list. Press the cursor keys to select route.

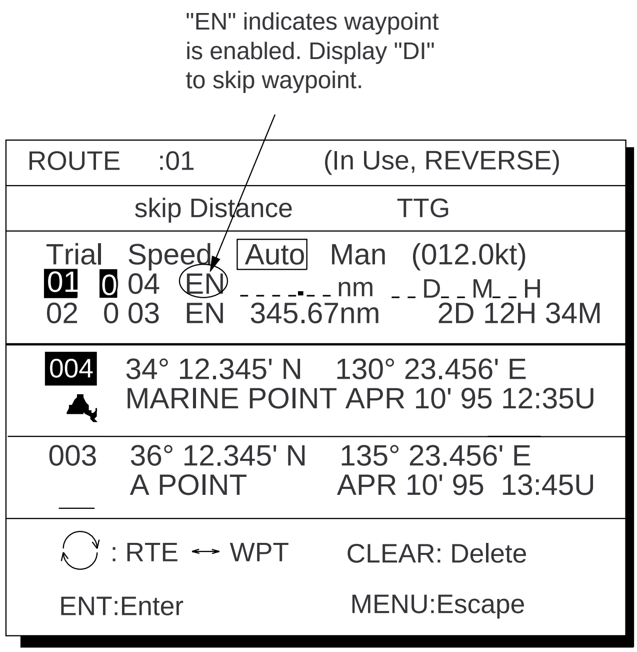


Figure 5-15 Route list

2) Press ▲ or ▼ to select route waypoint to skip.

3) Press ◀ or ▶ to shift the cursor to the right of the waypoint number.

4) Press [↻] to change "EN"(ENable) to "DI"(DIsable).

5) Press the [NU/CU ENT] key.

To reselect the waypoint, select it on the route list and press [↻] to change "DI" to "EN".

Route waypoints are mutually skipped when the navigators are sharing data.

5.2 Cancelling Destination

Destination is cancelled at both GPS navigators when they are sharing data.

1) Press the [GOTO] key.

2) Press [5] to select Cancel. The message shown in Figure 5-16 appears.

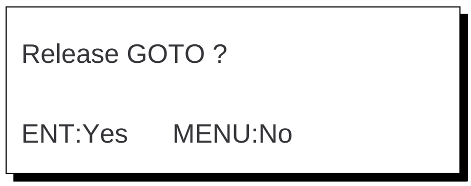


Figure 5-16

3) Press the [NU/CU ENT] key.

5.3 Erasing Route Waypoints (flags)

Flags are erased at both GPS navigators when they are sharing data.

1) Place the cursor on the flag to erase.

2) Press the [CLEAR] key. The message shown in Figure 5-17 appears if the waypoint is currently selected as destination, is part of a registered route, or is part of the route currently being navigated.

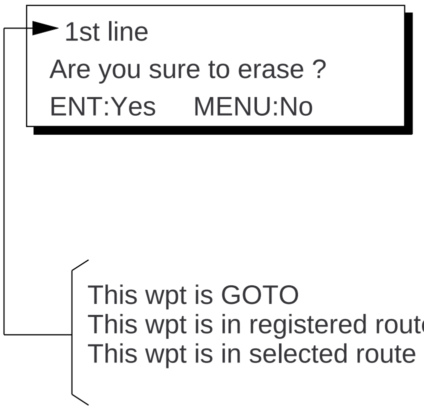


Figure 5-17

3) Press the [NU/CU ENT] key.

Note: Flags can be erased collectively by clearing the Plotter memory or both the Plotter memory and GPS memory. See page 9-1 for further details.

When flags are erased

When the origin waypoint is erased the waypoint before it becomes the origin waypoint. If there is no waypoint before the origin waypoint, current position becomes the origin waypoint.

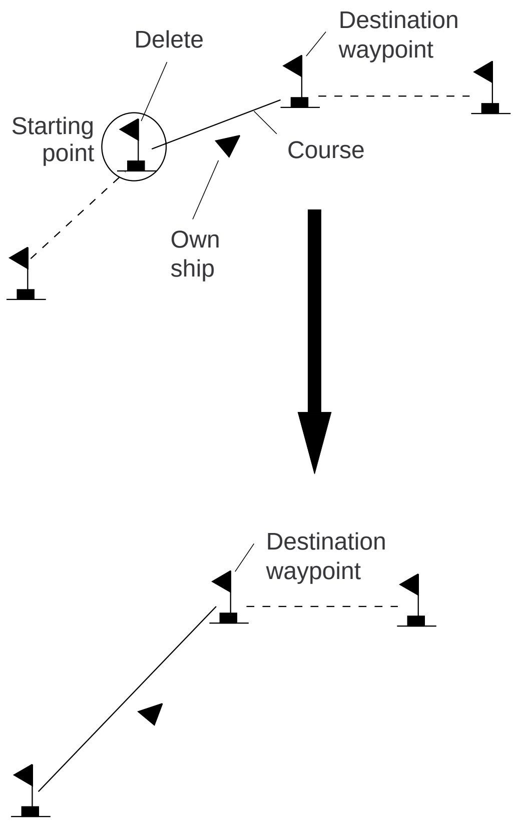


Figure 5-18 Route rearranged after erasing flag

When a destination is erased, the waypoint which follows it becomes the destination. If there is no waypoint after the destination waypoint erased, route navigation is cancelled.

5.4 Finding Range and Bearing Between Two Points

Calculation Procedure

You can find the range and bearing between two points by two waypoints or two latitude and longitude positions.

1) Press [MENU ESC] and [5]. The MANUAL CALCULATION menu appears.

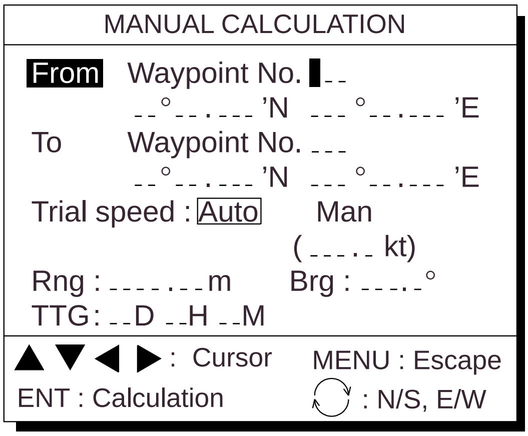


Figure 5-19 MANUAL CALCULATION menu

2) Choose two points by one the methods below.

   Latitude and longitude positions

   1) Press ▼.
   2) If necessary press to switch from North latitude and to South latitude vice versa.
   3) Key in latitude.
   4) If necessary press to switch from West longitude to East longitude and vice versa.
   5) Key in longitude.
   6) Press ▼.
   7) Repeat 2-5 to enter other point.

   Waypoints

   1) Key in first waypoint number (000-999). (000 is reserved for own ship position.)
   2) Press ▼ twice.
   3) Key in other waypoint number (000-999).

3) Press ▼ to shift the cursor to the Trial Speed line.

4) Press ◀ or ▶ to select Auto or Man. Auto uses ship's average speed to calculate time-to-go.

5) If you selected Man, enter speed.

6) Press the [NU/CU ENT] key.

The range, bearing and time-to-go between two points appear on the display. If data entered is wrong or insufficient the buzzer sounds and the message "INCOMPLETE DATA" appears. If the data contains error, "*" and all nines appear as the calculation results.

7) Press the [MENU ESC] key.

Selecting course sailing method

The range and bearing to a destination are calculated by two ways; Great Circle or Rhumb Line. However, cross track error is calculated by rhumb line only.

Great Circle: The great circle courseline is the shortest course between two points on the surface of the earth. (Imagine stretching a piece of yarn between two points on the earth.) However, this course requires frequent change of heading to follow course faithfully.

Rhumb Line: The rhumb line courseline is the straight line drawn between two points on a nautical chart. This course does not require frequent changes of heading however it is not the shortest since it follows the earth's curvature.

1) Press [MENU ESC] [9] and [1] to display the PLOTTER SETUP menu.

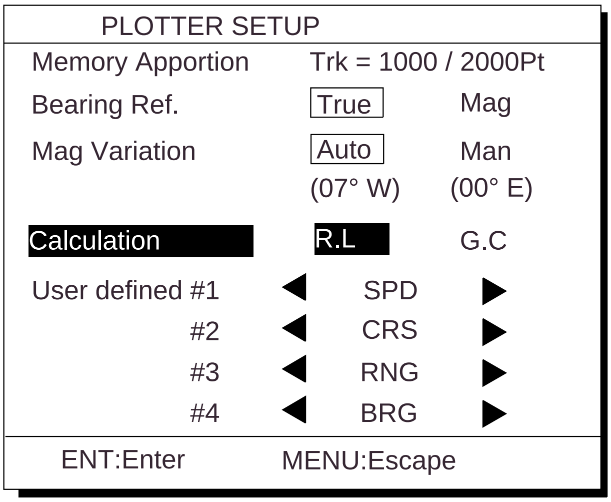


Figure 5-20 PLOTTER SETUP menu

2) Press ▲ or ▼ to selection Calculation.

3) Press ◀ or ▶ to select R.L (Rhumb Line) or G.C (Great Circle).

4) Press the [NU/CU ENT] key.

5) Press the [MENU ESC] key.

6. SETTING UP VARIOUS DISPLAYS

6.1 The Data Display

The user may select what data to display in four locations on the data display.

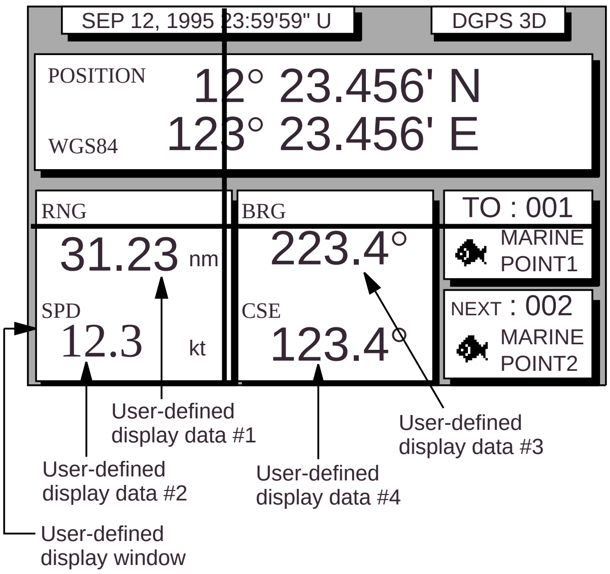


Figure 6-1 Data display

The data the user may display are;

- Altitude (ALT)*
- Average course (AVR CSE)
- Average speed (AVR SPD)
- Course (CSE)
- Course error (dCSE)
- Cross track error (XTE)
- Depth (W.DPT)#
- ETA to waypoint (ETA)
- Range to waypoint (RNG)
- Route time-to-go (RT.TTG)
- Speed (SPD)
- Time-to-go to waypoint (TTG)
- Total route distance (RT.DIST)*
- Trip distance (TRIP)
- Trip elapsed time (TRIP TM)
- Water temperature (W.TMP)#, and
- Velocity to destination (VTD)*
- ETA to route

***ALT:** Displayed only in 3D position fixing.
***RT. DIST:** Total distance from current position to ultimate destination. Appears when following a registered route or a cursor-created route.
***VTD:** When following a route, plus or minus appears next to indication to denote which direction the route is being traversed.

Requires external sensor.

1) Press [MENU ESC] [9] and [1] to display the PLOTTER SETUP menu.

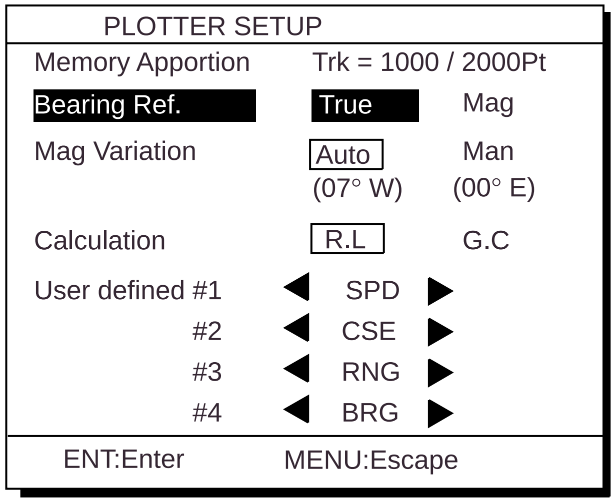


Figure 6-2 PLOTTER SETUP menu

2) Press ▲ or ▼ to select one of four of "User defined" (#1, #2, #3, #4).

3) Press ◀ or ▶ to select data to display.

4) Press the [NU/CU ENT] key. To select the data to display at other user defined displays, repeat steps 2 and 3.

5) Press the [MENU ESC] key.

6.2 Position Format

Position can be displayed in latitude and longitude, Loran C LOPs, or Decca LOPs, and the default format is latitude and longitude.

Selecting position format (L/L or LOPs)

1) Press [MENU ESC] [9] and [8] to display the LOP SETUP menu.

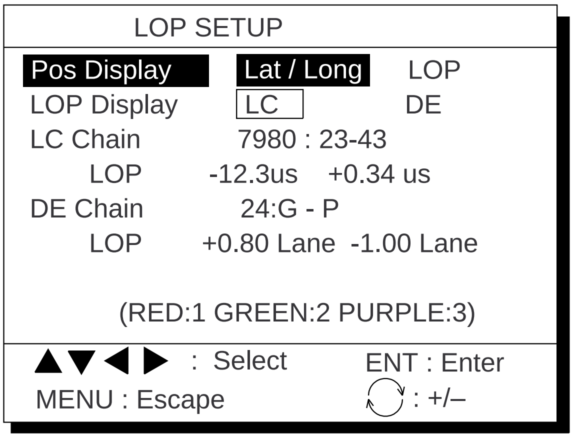


Figure 6-3 LOP SETUP menu

2) Press ▲ or ▼ to select Pos Display.
3) Press ◀ or ▶ to select Lat/Long or LOP.
4) Press the [NU/CU ENT] key.

Displaying LOPs

1) Press [MENU ESC] [9] and [8].
2) Press ▲ or ▼ to select Pos Display.
3) Press ◀ or ▶ to select LOP.
4) Press ▼ to select LOP Display.
5) Press ◀ or ▶ to select LC (Loran C) or DE (Decca).

Follow ① or ② in the adjacent column according to selection in step 5.

① For Loran LOPs

6) Press ▼ to select LC Chain.
7) Key in GRI code referring to the Loran C chain list appears in the Appendix. If the GRI code is 9970, for example, press [9] [9] [7] [0].
8) Key in secondary code pair referring to the Loran C chain list in the Appendix.
9) Press ▼.
10) Key in correction value.
11) If necessary, press [↻] to switch from plus to minus or vice versa.
12) Press the [NU/CU ENT] key.
13) Press the [MENU ESC] key.

② For Decca LOPs

6) Press ▼ to select DE Chain.
7) Key in Decca chain number referring to the Decca chain list in the Appendix. For the Europe chain, for example, press [0] [1].
8) Key in Decca lane pair. Red, [1]; Green [2], and Purple [3].
9) Press ▼.
10) Key in lane correction value.
11) If necessary, press [↻] to switch from plus to minus or vice versa.
12) Press the [NU/CU ENT] key.
13) Press the [MENU ESC] key.

Entering waypoints using LOPs

1) Press [WPT RTE] and [4].

2) Press [↻] to display LOPs.

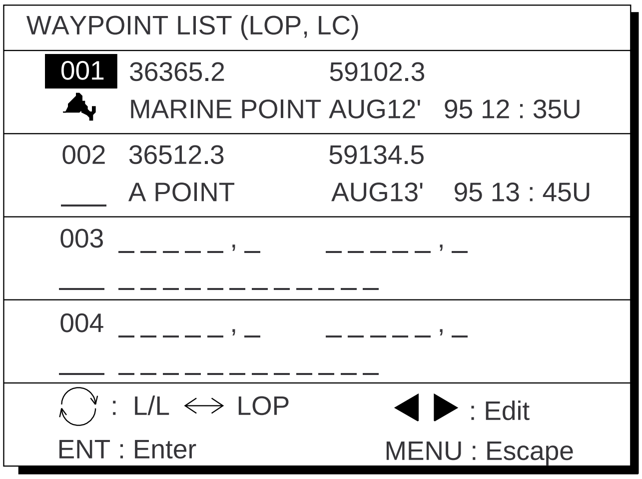
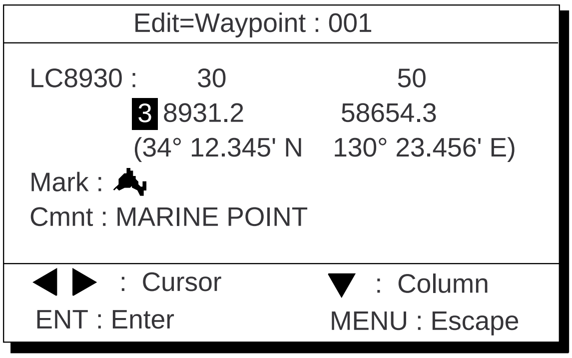


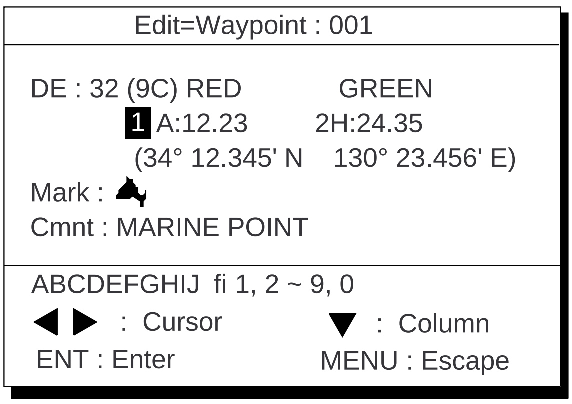
Figure 6-4 LOP display on the waypoint list

3) Press ▲ or ▼ to select waypoint number.

4) Press ◀ or ▶. Your display should look like one of the displays in Figure 6-5.



Loran C LOP input screen



Decca LOP input screen

Figure 6-5 LOP input screens

5) Key in LOP1 and LOP2, to enable calculation.

6) Press ▼ to calculate LOPs. "Calculating" appears between parentheses during the calculation. Actual LOPs replace "Calculating" upon completion of the calculation.

   If the conversion fails, the message "Failed in Conversion" appears for three seconds. Press the [CLEAR] key and reenter the right LOP1 and LOP2.

7) Press ◀ or ▶ to select mark.

8) Press the [NU/CU ENT] key.

9) Enter comment, if desired.

10) Press the [NU/CU ENT] key twice. Waypoint data and date and time registered appear.

6.3 Demo Display

The demo display provides simulated operation of this unit. Own ship tracks, at the speed selected, a figure eight course, starting from position entered. All controls are operative; you may change course, enter marks, etc.

1) While pressing and holding down [NU/CU ENT], turn on the power.

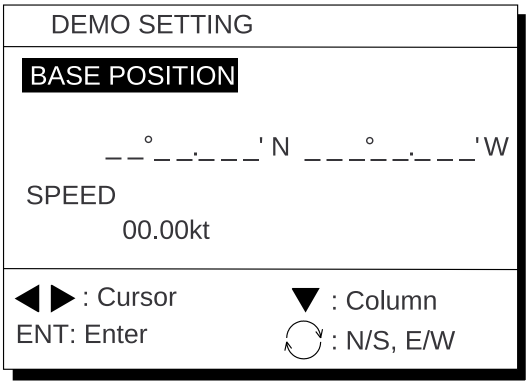


Figure 6-6 Simulation mode menu

2) Key in latitude of initial position.

3) If necessary, press [ ] to switch from north latitude to south latitude or vice versa.

4) Key in longitude.

5) If necessary, press [ ] to switch from east longitude to west longitude or vice versa.

6) Press ▼ key.

7) Key in speed.

8) Press the [NU/CU ENT] key to start the simulation mode. The plotter display appears and the simulation begins. After the test results appear, the Simulation Mode menu appears.

9) To quit the demo display, turn off the power.

All tracks, marks and data entered during the simulation are erased and default simulation mode settings restored.

7. ALARMS

7.1 Overview

There are seven alarm conditions which generate both aural and visual alarms.

When an alarm setting is violated, the buzzer sounds and the name of the alarm being violated appears on the display. The alarm icon also appears on the Plotter 1, Plotter 2 and Highway displays. This occurs on both navigators when they are sharing data.

Alarm status is output to external equipment through the DATA1 port and the DATA4 port when it outputs data in NMEA format.

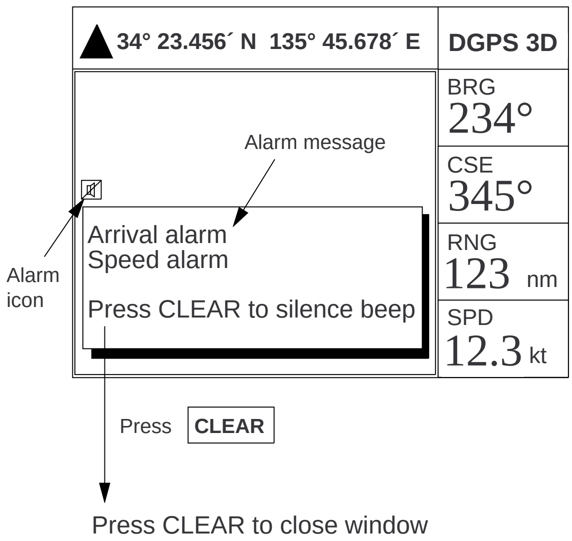


Figure 7-1 Location of alarm messages and alarm icon

Clearing the aural and visual alarms

Press the [CLEAR] key. When the navigators are sharing data, the "reset alarm signal" is transmitted to the other navigator to clear aural and visual alarms there.

Disabling an alarm

Select OFF instead of alarm name on the appropriate menu. This disables the alarm on both navigators when they are sharing data.

7.2 Arrival Alarm, Anchor Watch Alarm

Arrival alarm

The arrival alarm informs you that own ship is approaching a destination waypoint. The area that defines an arrival zone is that of a circle which you approach from the outside of the circle. The alarm will be released if own ship enters the circle.

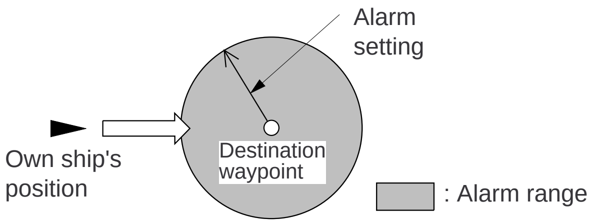


Figure 7-2 How the arrival alarm works

1) Press the [MENU ESC] key.
2) Press [4] to display the ALARM SETTINGS menu.

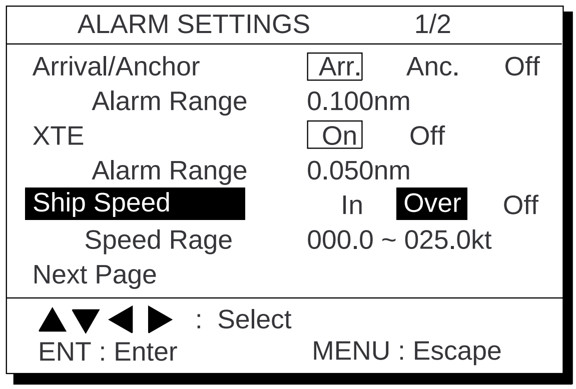


Figure 7-3 ALARM SETTINGS menu, page 1/2

3) Press ▲ or ▼ to select Arrival/Anchor.
4) Press ◀ or ▶ to select Arr.
5) Press ▼ to select Alarm Range.
6) Key in alarm range (0.001–9.999 nm).
7) Press the [NU/CU ENT] key.
8) Press the [MENU ESC] key.

When own ship nears a waypoint by the range set here, the buzzer sounds and the message "Arrival alarm" appears.

Anchor watch alarm

The anchor watch alarm sounds to warn you that own ship is moving when it should be at rest.

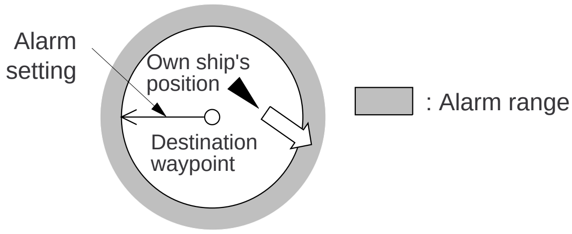


Figure 7-4 How the anchor watch alarm works

Before setting the anchor watch alarm, set present position as destination waypoint, referring to chapter 5.

1) Press [MENU ESC] and [4].
2) Press ▲ or ▼ to select Arrival/Anchor.
3) Press ◀ or ▶ to select Anc.
4) Press ▼ to select Alarm Range.
5) Key in alarm range (0.001–9.999 nm).
6) Press the [NU/CU ENT] key.
7) Press the [MENU ESC] key.

When own ship drifts by the range set here, the buzzer sounds and the message "Anchor alarm" appears.

7.3 Cross Track Error (XTE) Alarm

The XTE alarm warns you when own ship is off its intended course.

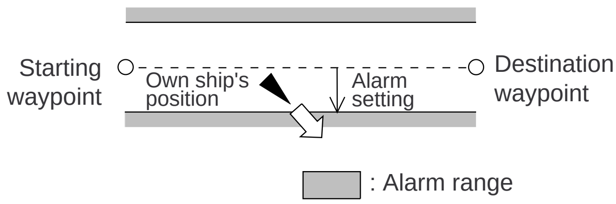


Figure 7-5 How the XTE alarm works

1) Press [MENU ESC] and [4].
2) Press ▲ or ▼ to select XTE.
3) Press ◀ or ▶ to select On.
4) Press ▼ to select Alarm Range.
5) Key in alarm range (0.001–9.999 nm).
6) Press the [NU/CU ENT] key.
7) Press the [MENU ESC] key.

When own ship strays from the intended track by the range set here, the buzzer sounds and the message "Cross track error alarm" appears.

7.4 Speed Alarm

The speed alarm sounds when ship's speed is lower or higher (or within) the alarm range set.

1) Press [MENU ESC] and [4].
2) Press ▲ or ▼ to select Ship Speed.
3) Press ◀ or ▶ to select In or Over.

   In: Alarm sounds when speed is within range set.

   Over: Alarm sounds when speed is higher or lower than range set.
4) Press ▼ to select Speed Range.
5) Key in low speed.
6) Key in high speed.
7) Press the [NU/CU ENT] key.
8) Press the [MENU ESC] key.

When speed is higher or lower (or within) than the speed set here, the buzzer sounds and the message "Speed alarm" appears.

7.5 Trip Alarm

The trip alarm sounds when the distance run is greater than the trip alarm setting.

1) Press [MENU ESC] and [4].
2) Press ▲ or ▼ to select Next Page. The menu shown in Figure 7-6 appears.

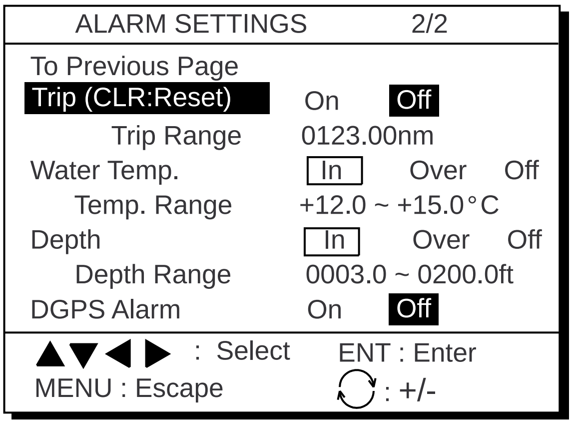


Figure 7-6 Alarm settings menu, page 2/2

3) Press ▲ or ▼ to select Trip.
4) If necessary, press [CLEAR] to reset the trip distance and trip elapsed time.
5) Press ◀ or ▶ to select On.
6) Press ▼ to select Trip Range.
7) Key in trip range.
8) Press the [NU/CU ENT] key.
9) Press the [MENU ESC] key.

When the ship's distance run is higher than the trip range set here, the buzzer sounds and the message "Trip alarm" appears.

7.6 Water Temperature Alarm

The water temperature alarm sounds when the water temperature is higher or lower (or within) the preset temperature. This alarm requires a temperature signal from external equipment.

1) Press [MENU ESC] and [4].
2) Press ▲ or ▼ to select Water Temp.
3) Press ◀ or ▶ to select In or Over.
4) Press ▼ to select Temp. Range.
5) Key in low temperature.
6) Key in high temperature.
7) Press the [NU/CU ENT] key.
8) Press the [MENU ESC] key.

When the water temperature is higher or lower (or within) the preset value, the buzzer sounds and the message "Water temp alarm" appears.

7.7 Depth Alarm

The depth temperature alarm sounds when the depth is higher or lower (or within) the preset depth. This alarm requires video sounder connection.

1) Press [MENU ESC] and [4].
2) Press ▲ or ▼ to select Depth.
3) Press ◀ or ▶ to select In or Over.
4) Press ▼ to select Depth Range.
5) Key in low depth.
6) Key in high depth.
7) Press the [NU/CU ENT] key.
8) Press the [MENU ESC] key.

When the depth is higher or lower (or within) the preset value, the buzzer sounds and the message "Depth alarm" appears.

7.8 DGPS Alarm

The DGPS alarm sounds when the DGPS signal is lost. This alarm may be enabled or disabled as below.

1) Press [MENU ESC] and [4].
2) Press ▲ or ▼ to select DGPS Alarm.
3) Press ◀ to select On, or ▶ to select off.
4) Press the [NU/CU/ENT] key.
5) Press the [MENU ESC] key.

8. MENU SETTINGS

8.1 GPS Menu

Menu description

Fix mode

Two position fixing modes are available: 2D and 2/3D. The 2D mode provides two dimensional position fixes (latitude and longitude only) and is used when three satellites are in line of sight of the GPS receiver.

The 2/3D mode switches between two and three dimension position fixing automatically depending on how many satellites (three or four) are in light of sight of the GPS receiver.

Disable satellite

Every GPS satellite is broadcasting abnormal satellite number(s) in the Almanac. Using this information, the GPS receiver automatically eliminates any malfunctioning satellite from the GPS satellite schedule. However, the Almanac sometimes may not contain this information. You can disable an inoperative satellite manually on the GPS SETUP menu.

GPS smoothing, position

When the DOP or receiving condition is unfavorable, the GPS fix may change greatly, even if the vessel is dead in water. This change can be reduced by smoothing the raw GPS fixes. A setting between 0 and 9 is available. The higher the setting the more smoothed the raw data, however too high a setting slows response time to change in latitude and longitude. This is especially noticeable at high ship's speeds. "0" is the normal setting; increase the setting if the GPS fix changes greatly.

GPS smoothing, speed

During position fixing, ship's velocity (speed and course) is directly measured by receiving GPS satellite signals. The raw velocity data may change randomly depending on receiving conditions and other factors. You can reduce this random variation by increasing the smoothing. Like with latitude and longitude smoothing, the higher the speed and course smoothing the more smoothed the raw data. If the setting is too high, however, the response to speed and course change slows. For no smoothing, enter "0." "5" is suitable for most conditions.

Speed average

Calculation of ETA and TTG, etc. is based on average ship's speed over a given period. The default setting is one minute.

Geodetic datum

Select the geodetic chart system you are using. WGS-84 (standard GPS chart system) and NAD 27 can be directly selected. For other charts, select "OTHER" and enter chart number referring to the geodetic chart list in the Appendix.

Position offset

You may apply an offset to position generated by the internal GPS receiver, to compensate for difference between GPS position and chart position.

Time difference

The GPS system uses UTC time. If you would rather use local time, enter the difference in hours between local time and UTC. Use the [+] and [–] keys for times later or earlier than UTC, respectively.

Position

Enter ship's position when cold starting (no satellite information in memory) the GPS receiver, to fix position faster. Accuracy should be within 10°.

Setting up the GPS menu

Fix mode

1) Press [MENU ESC] [9] and [6] to display the GPS SETUP menu.

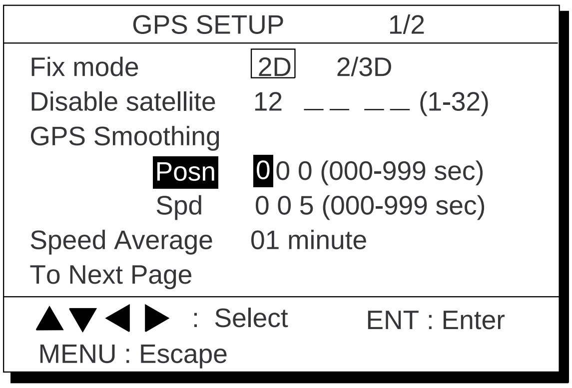


Figure 8-1 GPS SETUP menu, page 1/2

2) Press ▲ or ▼ to select Fix mode.
3) Press ◀ or ▶ to select fix mode desired.
4) Press ▼ to change other settings, or press [MENU ESC] to register settings and escape.

Disabling satellites

When the navigators are sharing data, satellites are disabled on both navigators.

1) Press [MENU ESC] [9] and [6].
2) Press ▲ or ▼ to select Disable satellite.
3) Key in satellite number, in two digits (01–32). Three sets of satellite numbers may be entered.
4) Press the [NU/CU ENT] key. If an invalid number is entered the buzzer sounds.
5) Press the [MENU ESC] key.

Note: To enable all disabled satellites, press the [CLEAR] key at step 3. All satellite numbers on the Disable satellite line are erased.

GPS position smoothing

1) Press [MENU ESC] [9] and [6].
2) Press ▲ or ▼ to select Posn.
3) Enter smoothing factor in three digits (001–999).
4) Press the [NU/CU ENT] key.
5) Press the [MENU ESC] key.

GPS speed smoothing

1) Press [MENU ESC] [9] and [6].
2) Press ▲ or ▼ to select Spd.
3) Enter smoothing factor in three digits (001–999).
4) Press the [NU/CU ENT] key.
5) Press the [MENU ESC] key.

Speed averaging

1) Press [MENU ESC] [9] and [6].
2) Press ▲ or ▼ to select Speed Average.
3) Enter smoothing factor in two digits (00–99).
4) Press the [NU/CU ENT] key.
5) Press the [MENU ESC] key.

Geodetic datum

1) Press [MENU ESC] [9] and [6].
2) Press ▲ or ▼ to select Geodetic Datum on page 2/2.

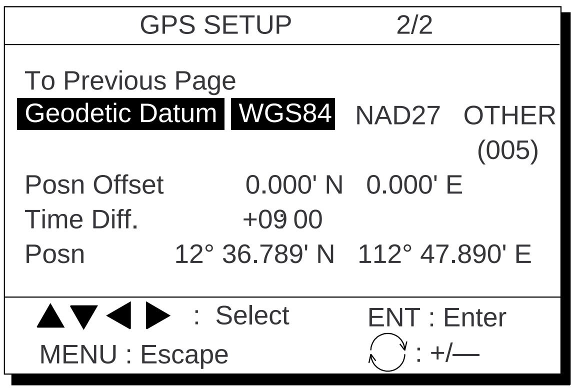


Figure 8-2 GPS SETUP menu, page 2/2

3) Press ◀ or ▶ to select geodetic datum to use. For geodetic datum other than WGS-72 or NAD-27, select OTHER and key in chart number (001–171) referring to the geodetic chart list in the Appendix.

4) Press the [NU/CU ENT] key.

5) Press the [MENU ESC] key.

Position offset

If you do not know the type of chart you are using, GPS position may be wrong. Note the difference in position when moored to a pier and enter it on the GPS SETUP menu, to get correct position.

1) Press [MENU ESC] [9] and [6].

2) Press ▲ or ▼ to select Posn Offset on page 2/2.

3) If necessary press [↻] to switch from north latitude to south latitude or vice versa.

4) Key in latitude correction.

5) If necessary press [↻] to switch from east longitude to west longitude or vice versa.

6) Key in longitude correction.

7) Press the [NU/CU ENT] key.

8) Press the [MENU ESC] key.

Time difference

1) Press [MENU ESC] [9] and [6].

2) Press ▲ or ▼ to select Time Diff on page 2/2.

3) Key in time difference (–14:00 to +14:00).

4) Press [↻] to change from plus to minus or vice versa.

5) Press the [MENU ESC] key.

Position

After the unit is installed you may enter position to shorten the time it takes to find position. (It takes about two minutes when there is no position data entered.)

1) Press [MENU ESC] [9] and [6].

2) Press ▲ or ▼ to select Posn on page 2/2.

3) If necessary, press [↻] to switch from north latitude to south latitude or vice versa. Key in latitude.

4) If necessary, press [↻] to switch from east longitude to west longitude or vice versa. Key in longitude.

5) Press the [NU/CU ENT] key.

6) Press the [MENU ESC] key.

8.2 Units of Measurement

Unit of distance

Distance can be displayed in nautical mile, kilometer or statute mile as follows.

1) Press [MENU ESC] [9] and [2]. The UNIT SETUP menu appears.

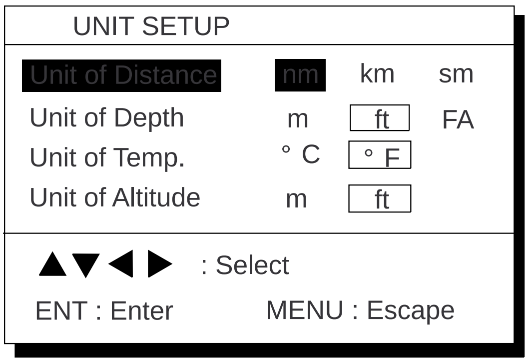


Figure 8-3 UNIT SETUP menu

2) Press ▲ or ▼ to select Unit of Distance.

3) Press ◀ or ▶ to select unit; nm, km or sm.

4) Press the [NU/CU ENT] key.

5) Press the [MENU ESC] key.

Unit of depth

1) Press [MENU ESC] [9] and [2].
2) Press ▲ or ▼ to select Unit of Depth.
3) Press ◀ or ▶ to select unit; meter, feet, or fathom.
4) Press the [NU/CU ENT] key.
5) Press the [MENU ESC] key.

Unit of water temperature

1) Press [MENU ESC] [9] and [2].
2) Press ▲ or ▼ to select Unit of Temp.
3) Press ◀ or ▶ to select unit; Centigrade or Fahrenheit.
4) Press [NU/CU ENT] and [MENU ESC].

Unit of altitude

Available only in 3D mode.

1) Press [MENU ESC] [9] and [2].
2) Press ▲ or ▼ to select Unit of Altitude.
3) Press ◀ or ▶ to select unit.
4) Press the [NU/CU ENT] key.
5) Press the [MENU ESC] key.

8.3 Size and Brilliance of Markers

The DISPLAY SETUP menu lets you select the size and brilliance of various markers.

Grid tone

The grid can be displayed in light or dark tone, or turned off.

1) Press [MENU ESC] and [1]. The DISPLAY SETUP menu appears.

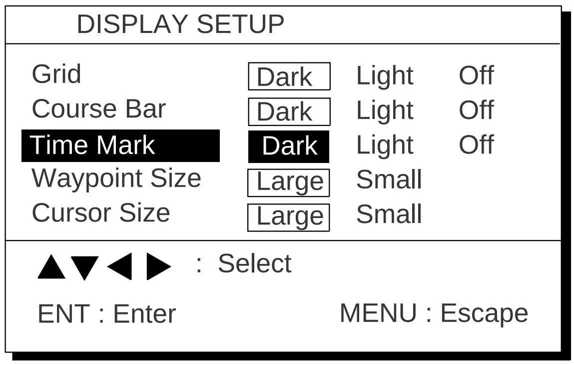


Figure 8-4 DISPLAY SETUP menu

2) Press ▲ or ▼ to select Grid.
3) Press ◀ or ▶ to select brilliance.
4) Press [NU/CU ENT] and [MENU ESC].

Course bar tone

The course bar can be displayed in light or dark tone, or turned off.

1) Press [MENU ESC] and [1].
2) Press ▲ or ▼ to select Course Bar.
3) Press ◀ or ▶ to select brilliance.
4) Press the [NU/CU ENT] key.
5) Press the [MENU ESC] key.

Time mark tone

The time mark can be displayed in light or dark tone, or turned off.

1) Press [MENU ESC] and [1].
2) Press ▲ or ▼ to select Time Mark.
3) Press ◀ or ▶ to select brilliance.

4) Press the [NU/CU ENT] key.

5) Press the [MENU ESC] key.

Waypoint mark size

The size of the waypoint mark can be selected to large or small.

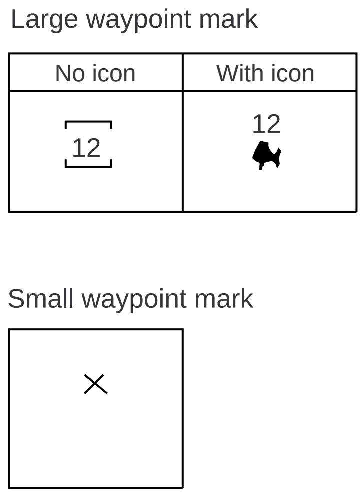


Figure 8-5 Waypoint mark size

1) Press [MENU ESC] and [1].

2) Press ▲ or ▼ to select Waypoint Size.

3) Press ◀ or ▶ to select Large or Small.

4) Press [NU/CU ENT] and [MENU ESC].

Cursor size

The size of the cursor can be selected to large or small.

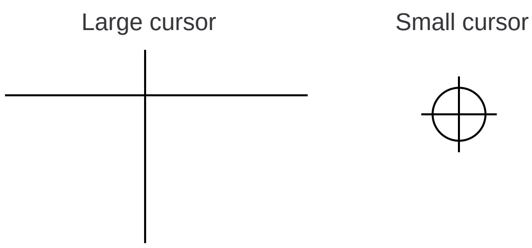


Figure 8-6 Cursor size

1) Press [MENU ESC] and [1].

2) Press ▲ or ▼ to select Cursor Size.

3) Press ◀ or ▶ to select Large or Small.

4) Press the [NU/CU ENT] key.

5) Press the [MENU ESC] key.

Enlarging characters

The size of the indications of position or user defined display areas can be enlarged on the Data display.

1) On the Data display, with no enlarged characters, press the [CURSOR ON/OFF] key to turn on the cursor.

2) Operate the cursor keys to select data to enlarge in the window.

3) Press the [ZOOM IN] key.

To switch character size from enlarged to normal, press the [ZOOM OUT] key at step 3.

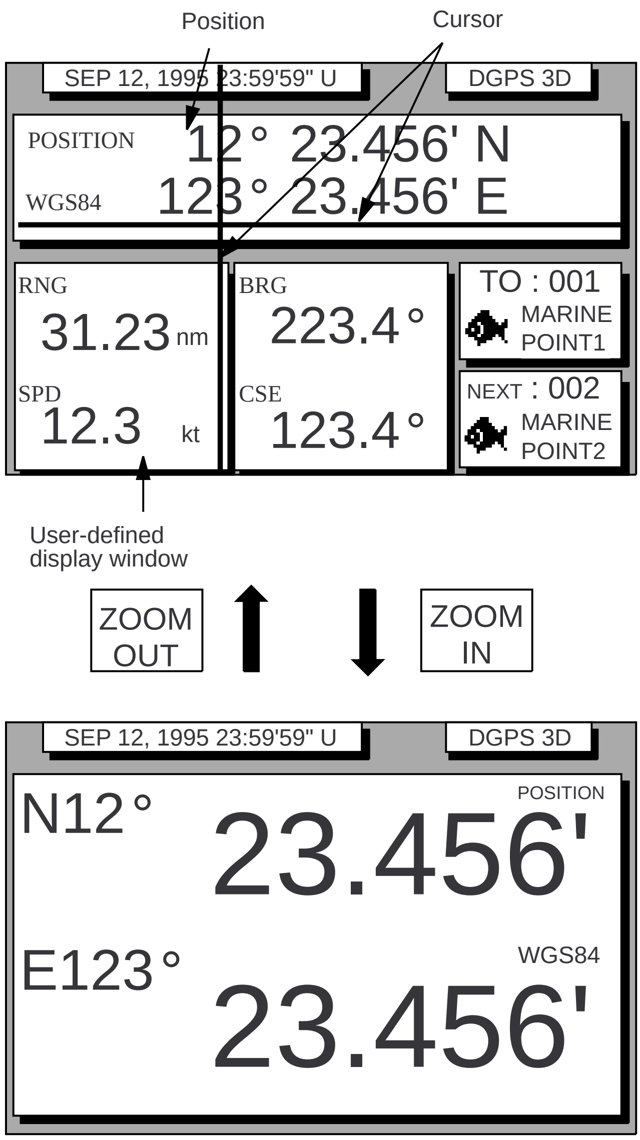


Figure 8-7 How to enlarge indications on the data display

8.4 Outputting Data

Besides its fundamental function of displaying position, the DD-80 can also receive data and output data to external equipment, through an interface unit. Before outputting data to external equipment, first determine what data the external equipment requires. Output only necessary data to ensure data will be output correctly.

All data transmitted by marine electronics equipment are prefixed with a two character code called a talker. The same talker must be shared by the transmitting and receiving equipment to transmit and receive data successfully. The DD-80 transmits data using the GP (GPS talker), Loran (LC) or Decca (DE) talker.

If the external equipment does not recognize the GP talker use one it does regcognize, like LC.

DATA 1 output setting

1) Press [MENU ESC] [9] and [3]. The DATA 1,3 OUTPUT SETUP menu appears.

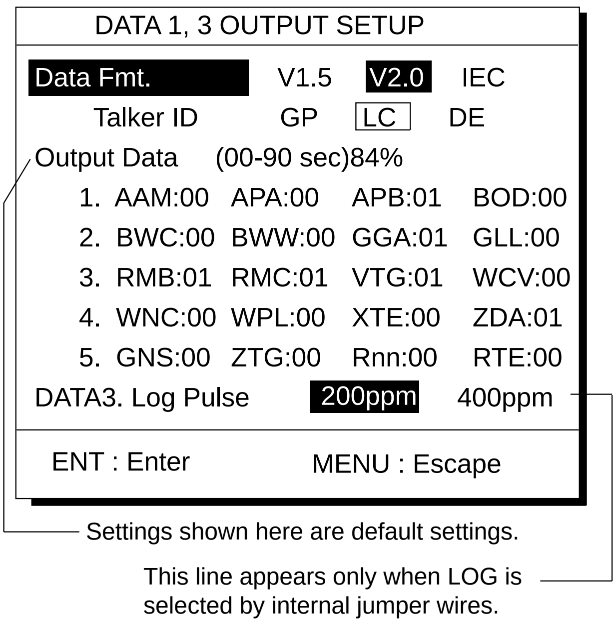


Figure 8-8 DATA 1 OUTPUT SETUP menu

2) Press ▲ or ▼ to select Data Fmt.
3) Press ◀ or ▶ to select NMEA 0183 (V1.5 or V2.0) or IEC 61162-1.
4) Press the [NU/CU ENT] key. Talker ID appears in reverse video.
5) Press ◀ or ▶ to select GP, LC or DE.
6) Press the [NU/CU ENT] key.
7) Enter Tx interval for each output data sentence in line 1. Tx interval is available in 00, 01, 02, 03, 04, 05, 06, 10, 15, 20, 30, 60 and 90 (seconds).
8) Press the [NU/CU ENT] key.
9) Enter Tx interval for each output data sentence in lines 2 through 5. Press the [NU/CU ENT] key after setting each line.

For detailed information about Tx interval see the installation manual. However, the Tx interval settings entered by the installer of the equipment should not be changed unless absolutely necessary.

BWC and WNC are for great circle navigation and BWR and WNR are for rhumb line. However, all output data are calculated by rhumb line.

The total data output are shown by percentage on the third line. For best results the total output should not exceed 90%; lengthen the Tx interval of less important data to make the total output less than 90%.

DATA 3 output setting

The DATA 3 connector can output IEC 61162-1/NMEA 0183 data or log pulse. For NMEA 0183,IEC 61162-1 the same data output by DATA 1 is output from DATA 3.

For log pulse, select 200 or 400 pulse per second depending on the device connected.

1) Press [MENU ESC] [9] and [3].
2) Press ▲ or ▼ to select DATA 3 or Log Pulse.
3) For log pulse, press ◀ or ▶ to select log pulse of external equipment; 200 ppm or 400 ppm.
4) Press the [NU/CU ENT] key twice.

Setting DATA 4 to Data Output

The DATA 4 port connects to a personal computer, DGPS receiver or YEOMAN equipment.

1) Press [MENU ESC] [9] and [5]. The DATA 4 I/O SETUP (1/2) menu appears.

DATA 4 I/O SETUP		1/2	
DATA 4. Level	RS232C	RS422	
Data	Out	Com.	DGPS
To Next Page			
▲▼◀▶ : Select			
ENT : Enter	MENU : Escape		

Figure 8-9 DATA 4 I/O SETUP menu (1/2)

2) Press ▲ or ▼ to select Level.

3) Press ◀ or ▶ to select level of external equipment; RS232C or RS422.

4) Press the [NU/CU ENT] key.

5) Press ◀ or ▶ to select Out.

6) Press ▼ to select To Next Page. The DATA 4 I/O SETUP (2/2) menu appears.

DATA 4 I/O SETUP <Out> 2/2				
To Previous Page				
Data Fmt.	V1.5	V2.0	IEC	
Talker ID	GP	LC	DE	
Output Data	(00-90 sec)	84%		
1.	AAM:00	APA:00	APB:01	BOD:00
2.	BWC:00	BWW:00	GGA:01	GLL:00
3.	RMB:01	RMC:01	VTG:01	WCV:00
4.	WNC:00	WPL:00	XTE:00	ZDA:01
5.	GNS:00	ZTG:00	Rnn:00	RTE:00
ENT : Enter	MENU : Escape			

Figure 8-10 DATA 4 I/O SETUP menu (2/2)

7) Follow "DATA 1 output setting" from step 2.

8.5 Receiving Data from Personal Computer

Loading waypoint/route data

Waypoints and routes data can be downloaded from a personal computer, through the DATA 4 connector.

1) Press [MENU ESC] [9] and [5].

2) Press ▲ or ▼ to select Level.

3) Press ◀ or ▶ to select level of personal computer; RS232C or RS422.

4) Press the [NU/CU ENT] key.

5) Press ▶ to select Com.

6) Press ▼ to select To Next Page. The DATA 4 I/O SETUP menu appears.

DATA 4 I/O SETUP <Com.> 2/2			
To Previous Page			
Baud Rate	◀ 9600 bps ▶		
Load Data	L.House*	WPT/RTE	WPT
Command	Stop	Start	
Save Data	WPT/RTE		
Command	Stop	Start	
▲▼◀▶ : Select			
ENT : Enter	MENU : Escape		

*: Not used.

Figure 8-11 DATA 4 I/O SETUP menu (2/2)

7) Press ▲ or ▼ to select Baud Rate.

8) Press ◀ or ▶ to select baud rate; 400 bps, 9600 bps, or 19200 bps.

9) Press the [NU/CU ENT] key.

10) Press ◀ or ▶ to select WPT/RTE.

11) Press ▼ to select Command. Stop, on the same line as Command, appears in reverse video.

12) Press ▶ to select Start. The message shown in Figure 8-12 appears.

Loading erases current data
and stops Route navigation
Are you sure to load?

ENT: Yes   MENU: No

Figure 8-12

13) Press the [NU/CU ENT] key. The message shown in Figure 8-13 appears.

```
Now loading
Waypoint/Route data !

MENU:Stop
```

Figure 8-13

14) Operate the computer to output data. When data is loaded, the cursor shifts to Stop.

15) Press the [MENU ESC] key. When data is loaded successfully, The message in Figure 8-14 appears.

```
Loading ended successfully

Press any key
```

Figure 8-14

If data could not be loaded, the message shown in Figure 8-15 appears.

```
Failed in loading
Invalid data
Press any key
```

Figure 8-15

Stopping loading of data

1) Press the [MENU ESC] key. The message shown in Figure 8-16 appears.

```
Are you sure to stop ?

ENT: Yes      MENU:No
```

Figure 8-16

2) To quit loading, press the [NU/CU ENT] key. The cursor shifts to Stop.

3) To start loading, select Start.

4) Press the [NU/CU ENT] key.

Loading waypoint data from YEOMAN equipment

1) Do steps 1 through 9 in "Loading lighthouse data."

2) Press ◀ or ▶ to select WPT.

3) Press ▼ to select Command.

4) Press ▶ to select Start. The message shown in Figure 8-17 appears.

```
Are you sure to load ?

ENT: Yes      MENU:No
```

Figure 8-17

5) Press the [NU/CU ENT] key. The message shown in Figure 8-18 appears.

```
Now loading
Waypoint data !

MENU:Stop
```

Figure 8-18

6) Operate the YEOMAN to output data.

When data is loaded, the cursor automatically shifts to "Stop". Waypoints are loaded into empty areas. When the waypoint area becomes full, the message shown in Figure 8-19 appears.

```
Waypoint area is full !
Can't load any data
Press any key to stop
```

Figure 8-19

7) When the data is loaded, press [CU/NU ENT] and [MENU ESC]. The message shown in Figure 8-20 appears.

The number of valid and invalid waypoints appears in the message.

```
Loading completed
Valid waypoint   :  0
Invalid waypoint :  0
Press any key
```

Figure 8-20

8) Press the [MENU ESC] key twice.

Saving data to personal computer

Waypoint and route data can be saved to a personal computer.

1) Press [MENU ESC] [9] and [5].
2) Press ▲ or ▼ to select Level.
3) Press ◀ or ▶ to select level; RS232C or RS422.
4) Press the [NU/CU ENT] key. "Data" appears in reverse video.
5) Press ▶ to select Com.
6) Press ▼ to select Next Page.
7) Press ▲ or ▼ to select Baud Rate.
8) Press ◀ or ▶ to select baud rate; 400bps, 9600bps, or 19200bps.
9) Press ▼ to select Command (under the Save Data line). Stop, on the same line as Command, appears in reverse video.
10) Press ▶ to select Start. The message shown in Figure 8-21 appears.

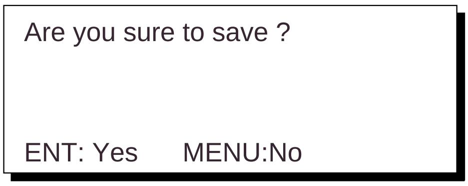


Figure 8-21

11) Press the [NU/CU ENT] key. The message shown in Figure 8-22 appears while data is being saved.

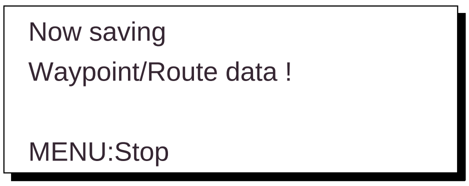


Figure 8-22

12) Save data at the computer.
13) Press the [MENU ESC] key. When data is saved, the cursor shifts to Stop.
14) Press the [MENU ESC] key.

8.6 DGPS Settings

A DGPS beacon receiver may be connected to the DD-80 to further refine position accuracy. Set up to receive the DGPS beacon signal as follows.

Selecting DGPS station

The default setting is "manual".

Automatic

The DGPS beacon receiver can automatically select optimum reference station by feeding it position data. If it takes more than 5 minutes to fix DGPS position at the automatic mode, switch to manual mode. Use at manual mode when a external beacon receiver has no automatic function of station selection.

1) Press [MENU ESC] [9] and [7] to display the DGPS SETUP menu.

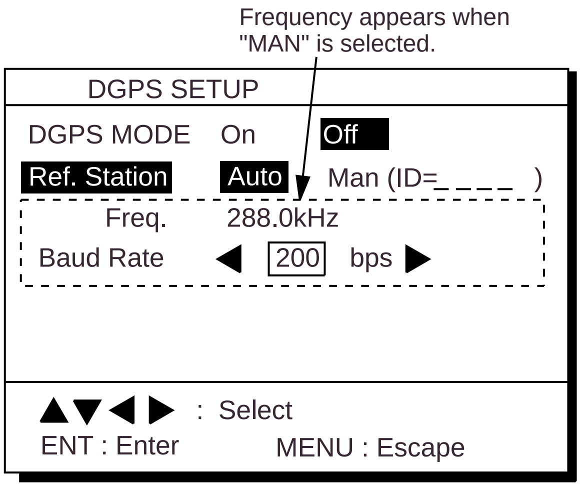


Figure 8-23 DGPS SETUP menu

2) Set DGPS MODE On.
3) Press ▲ or ▼ to select Ref. Station.
4) Press ◀ or ▶ to select Auto.
5) Press the [NU/CU ENT] key.
6) Press the [MENU ESC] key.

Manual selection of DGPS station

Manual

Enter four digit ID number, frequency and baud rate of station.

Reference

- ID number: Appendix at end of this manual
- Frequency, baud rate : "DGPS REFERENCE LIST"

1) Press [MENU ESC] [9] and [7] to display the DGPS SETUP menu.
2) Press ▲ or ▼ to select Ref. Station.
3) Press ◀ or ▶ to select Man.
4) Enter four digit ID number. You can clear an entry by the [CLEAR] key. If the number entered is invalid, the buzzer sounds and the message "INVALID ID" appears on the display for three seconds.

   If there is no ID number, press the [CLEAR] key.
5) Press the [NU/CU ENT] key.
6) Enter frequency in four digits (283.5 kHz to 325.0 kHz).
7) Press the [NU/CU ENT] key. "Baud Rate" appears in reverse video.
8) Press ◀ or ▶ to select baud rate; 25, 50, 100 or 200 bps.
9) Press the [MENU ESC] key.

8.7 GPS Monitor Display

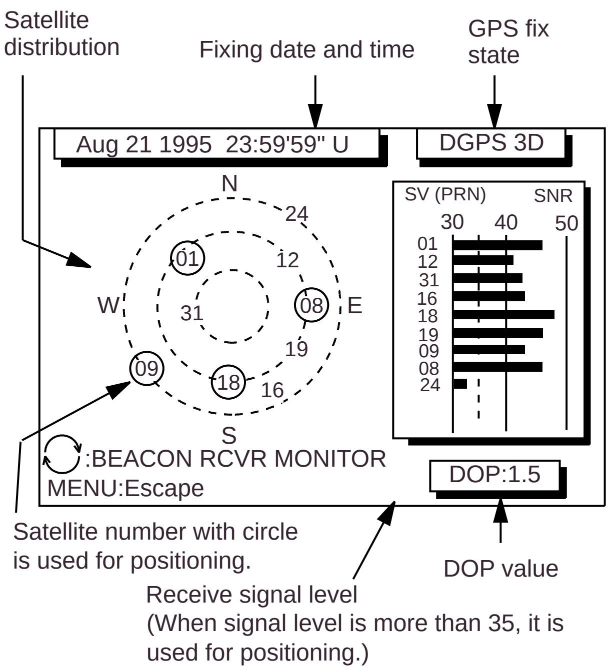
Three GPS monitor displays provide GPS information:

- **Satellite monitor** which shows position of GPS satellites
- **Beacon receiver monitor** which displays DGPS beacon station information
- **DGPS beacon station message monitor** which displays messages received from beacon stations

To display the GPS monitor displays;

1) Press [MENU ESC] [7].
2) Press [⟳] to display the GPS monitor you want to view.
3) Press the [MENU ESC] to escape.

Number, bearing and elevation angle of all satellites in view of the GPS receiver appear. Satellites being used in fixing position are circled with a solid line; satellites not being used in fixing position are circled with a dashed line.



SATELLITES MONITOR

⇓

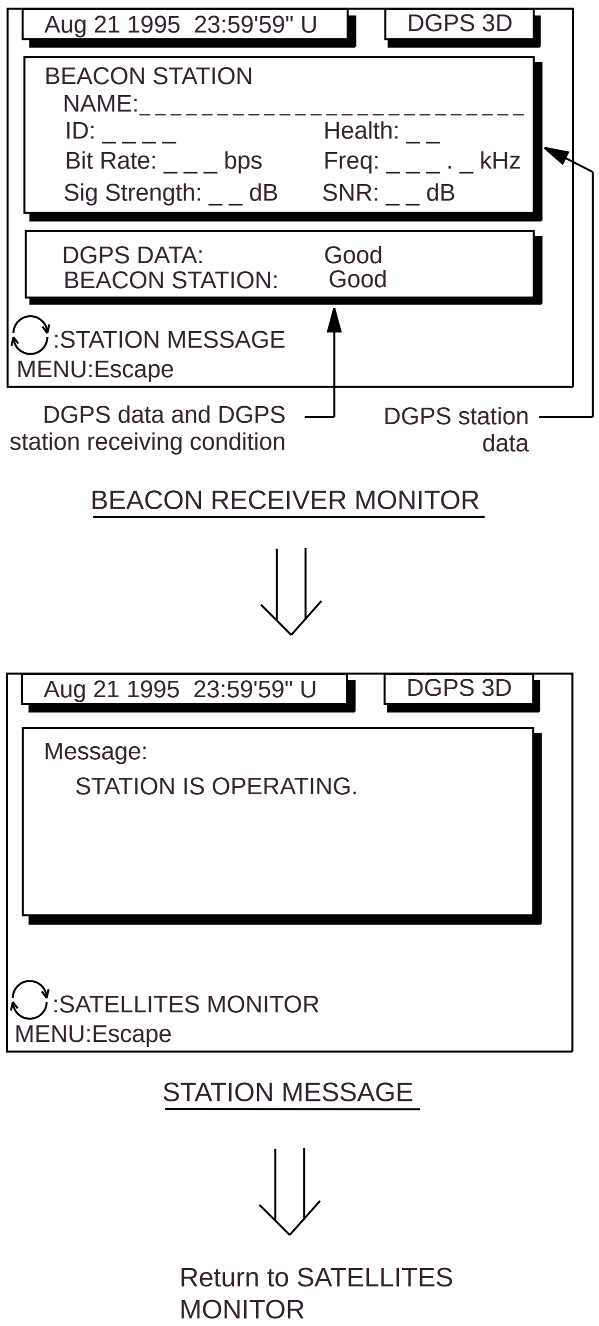


Figure 8-24 GPS monitor displays

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9. MAINTENANCE & TROUBLESHOOTING

9.1 Clearing the Memory

The DD-80 has two memories: GPS memory and plotter memory.

Clearing the plotter memory

The plotter memory holds plotted track and mark data. When you clear the plotter memory, all track and marks are cleared and all corresponding defaults settings are restored.

1) Press [MENU ESC] [9] and [9] to display the CLEAR MEMORY menu.

```
CLEAR MEMORY

Clear Plotter   No    Yes
Clear GPS       No    Yes
Clear All       No    Yes

▲ ▼ ▶   : Select
MENU : Escape
```

Figure 9-1 CLEAR MEMORY menu

2) Press ▲ or ▼ to select Clear Plotter.
3) Press ▶ to select Yes. The following message appears.

```
Clear tracks and marks
Are you sure to clear ?
 ENT:Yes   MENU:No
```

Figure 9-2

4) Press the [NU/CU ENT] key.

Clearing the GPS memory

The GPS memory stores GPS information, including the Almanac. When you clear the GPS memory, all GPS information is erased.

1) Press [MENU ESC] [9] and [9] to display the CLEAR MEMORY menu.
2) Press ▲ or ▼ to select Clear GPS.
3) Press ▶ to select Yes. The following message appears.

```
Setting for cold start
Are you sure to clear ?
 ENT:Yes   MENU:No
```

Figure 9-3

4) Press the [NU/CU ENT] key.

Clearing GPS and plotter memories

To clear both GPS and plotter memories;

1) Press [MENU ESC] [9] and [9] to display the CLEAR MEMORY menu.
2) Press ▲ or ▼ to select Clear All.
3) Press ▶ to select Yes. The message shown in Figure 9-4 appears.

```
Setting for default
Are you sure to clear ?
 ENT:Yes   MENU:No
```

Figure 9-4

4) Press the [NU/CU ENT] key.

Note: The equipment may lock after clearing GPS and plotter memories. Reapply power to the equipment to restore normal operation.

9.2 Preventative Maintenance

Regular maintenance is necessary to maintain performance. Check the items mentioned below monthly to keep the equipment in good working order.

Antenna unit

Check for fixing bolts for tightness.

Antenna cable

Check connector for tightness, rust, damage and water leaks.

Power cable

Check for tight connection.

Ground terminal

Check for rust and tight connection.

Fuse

The 2A fuse in the power cable protects the unit from overvoltage and equipment fault. If the fuse blows, find out the cause before replacing the fuse. If the fuse blows after replacement, request service.

⚠ CAUTION

Use of a wrong fuse can cause permanent equipment damage.

9.3 Error Messages

Error messages appear on the display to alert you to possible trouble.

GPS error

When GPS signal is suddenly lost and position cannot be calculated within one minute the message shown in Figure 9-5 appears.

GPS No fix

Figure 9-5 GPS error message

This message may appear when there is an interfering object between the satellite and GPS receiver (for example, mast) or the antenna cable is disconnected.

DOP error

When PDOP value exceeds 6 in the 3D mode, or HDOP value exceeds 4 in the 2D mode, this error occurs and following indication appears.

DOP Error

Figure 9-6 DOP error message

DGPS error

When DGPS data contains errors or the DGPS beacon station is experiencing transmitting problems, the message shown in Figure 9-7 appears.

DGPS error

Figure 9-7 DGPS error message

Self test error message

If the self test (conducted when turning on the power) finds equipment error, the message shown in Figure 9-8 appears.

GPS No fix   GPS SELFTEST error XX

Figure 9-8 Self test error message

If the self test error message appears, consult your dealer for advice.

9.4 Troubleshooting

The table which follows provides troubleshooting procedures which you can follow to restore normal operation. If normal operation cannot be restored, ask your dealer for advice.

Table 9-1 Troubleshooting table

If...	**Then...**
you cannot turn on the power	• check power connector for tight connection. • check if ship's mains is off. • check for blown fuse.
position cannot be fixed	• check antenna cable for tight connection and water leakage. • check if functional satellite has been disabled: [MENU ESC] [9] [6]
position is wrong	• check if correct geodetic chart is entered: [MENU ESC] [9] [6] • apply position correction to GPS position: [MENU ESC] [9] [6]
position sometimes cannot be fixed	• DOP figure may be too small. Enter larger figure; 20 is the usual setting.
data cannot be transmitted to external equipment	• check if data format is correct: [MENU ESC] [9] [3] ([9] [4] or [9] [5]) See the installation manual for further details. • Tx interval may be set to "0". Select proper interval: [MENU ESC] [9] [3] ([9] [4] or [9] [5]) See the installation manual for further details. • Check appropriate settings on external equipment. • Check connections: DD-80 → Ext. equipment TXD-H → RXD-H TXD-C → RXD-C

9.5 Diagnostic Tests

Memory and I/O port test

1) Press [MENU ESC] and [8] to display the SELF TESTS menu.

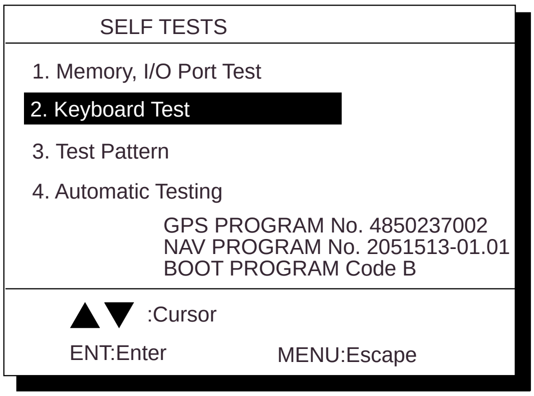


Figure 9-9 SELF TESTS menu

2) Press [1].

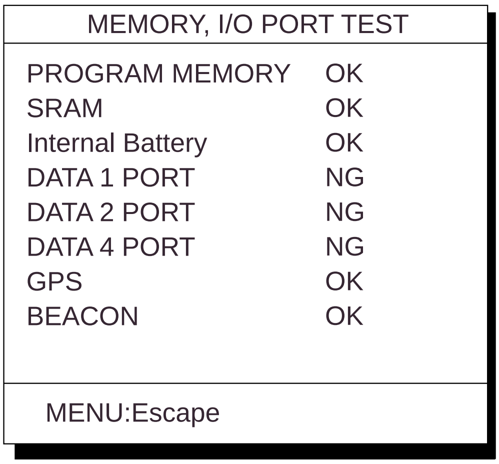


Figure 9-10 MEMORY, I/O PORT TEST display

3) When testing is finished, press the [MENU ESC] key to escape and return to the Self Test menu. (Testing continues if the key is not pressed.)

   OK appears to the right of PROGRAM, SRAM and Internal Battery when those devices are normal; NG (No Good) appears when an abnormality is found.

   OK appears to the right of GPS and BEACON when they are normal; NG and 16 hexadecimal figure appear when an abnormality is found.

   Whenever NG or 16 hexadecimal figure appears contact your dealer for advice.

   DATA 1 PORT, DATA 2 PORT and DATA 4 PORT show results of communication interface test. A special test connector is required to test those ports. NG appears as the results of the self test when there is no test connector attached.

4) Press the [MENU ESC] key to escape.

Keyboard test

1) Press [MENU ESC] [8] and [2] to display the KEYBOARD TEST screen.

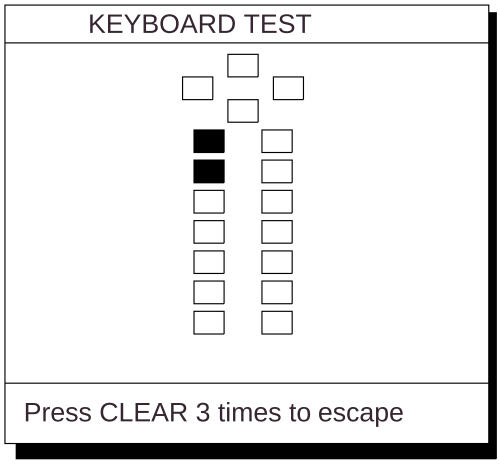


Figure 9-11 KEYBOARD TEST screen

2) Press each key one by one. A key's corresponding location on the screen lights in reverse video if the key is normal.
3) To quit the keyboard test, press the [CLEAR] key three times. Control is returned to the SELF TESTS menu.
4) Press the [MENU ESC] key.

Display test

1) Press [MENU ESC] [8] and [3] to display the test pattern screens.

2) To change the test pattern, press the [NU/CU ENT] key. Each time the key is pressed one of the patterns shown in Figure 9-12 appears.

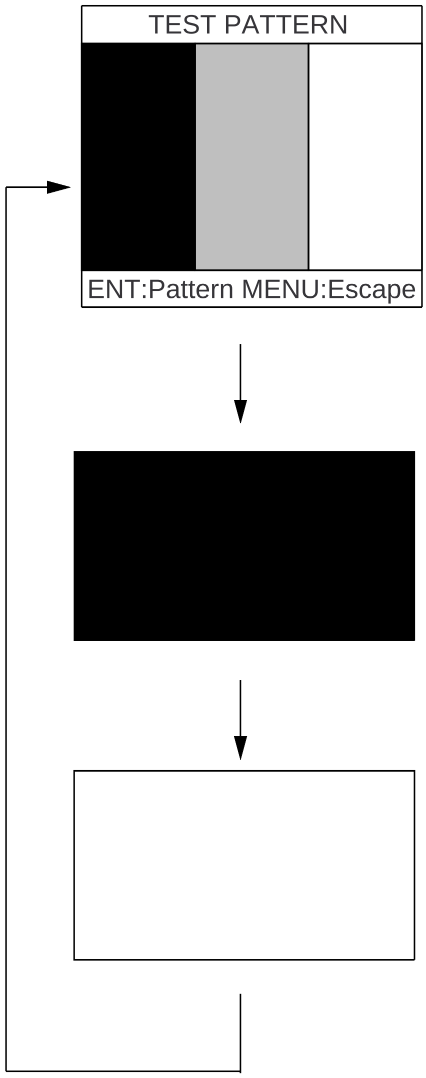


Figure 9-12 Test patterns 1 and 2

3) To quit the test pattern, press the [CLEAR] key three times. Control is returned to the SELF TESTS menu.

4) Press the [MENU ESC] key.

Automatic testing

This feature conducts all self tests continuously.

1) Press [MENU ESC] [8] and [4]. Self tests are conducted continuously in the order of memory, I/O test, keyboard test and test pattern.

2) To stop testing, press the [MENU ESC] key.

3) Press the [MENU ESC] key.

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10. INTRODUCTION TO GPS

10.1 What is GPS?

GPS is an acronym meaning Global Positioning System. GPS is a highly precise satellite navigation system developed by the U.S. Department of Defense.

A constellation of 24 satellites emplaced in nearly 20,000-kilometer high 12-hour circular orbits provides highly precise, continuous, worldwide, all-weather position plus time and velocity information to GPS receiver-equipped vehicles, vessels and aircraft.

All GPS satellites transmit at the same frequency of 1575.42 MHz, and each satellite has a unique signal coding scheme, so that it can be identified by a GPS receiver.

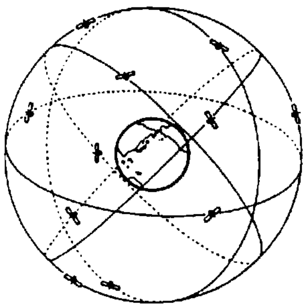
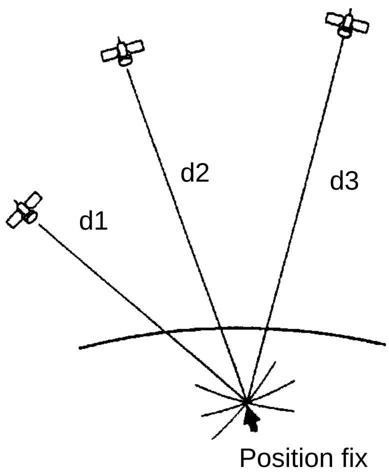


Figure 10-1 GPS satellite orbital pattern

10.2 How the GPS Receiver Calculates Position

The basic steps in position fixing are as follows:

1) GPS satellites continually transmit their own precise orbital data called ephemeris. The GPS receiver computes satellites' position by this data.
2) The GPS receiver measures very accurate distance to the satellites.
3) The GPS receiver fixes its position by the intersecting point of three satellite positions.



① Satellites locations are measured.
② Distances are measured.
③ Position fix is point of intersection of three spheres which are drawn around the three satellites with diameter d1, d2 and d3.

Figure 10-2 How the GPS receiver calculates position

10.3 What is Differential GPS (DGPS)?

Differential GPS is based upon accurate knowledge of the accurate geograhical location of a reference station which is used to compute corrections to GPS parameters, error sources and resultant positions. These differential corrections are transmitted to GPS users, who apply the corrections to their received GPS signals or computed position. For civil users, differential corrections can improve navigational accuracy from 100 meters to better than 3 meters.

The DPGS reference stations, located throughout North America and Europe, are fixed at a geodetically surveyed position. The reference station tracks all satellites in view, downloads ephemeric data from them, and computes corrections based on its measurement and geodetic position. These corrections are then broadcast to GPS users by radio beacons to improve their position solution.

The radio beacons broadcast in the frequency range of 285–325 kHz and have a transmitting range from 40 nm to 300 nm depending on radio beacon.

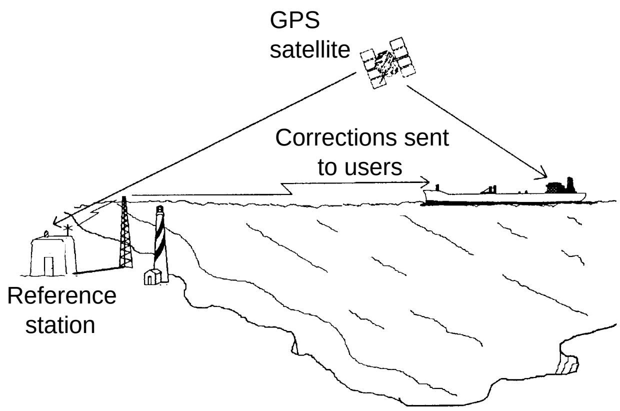


Figure 10-3 DGPS system concept

Specifications of DD-80

GPS Receiver

Number of receiving channels	12 channels, 12 satellite tracking
Rx frequency	1575.42 MHz
Rx code	C/A code
Antenna	Flat antenna
Position fixing system	All in view, 8-state Kalman filter
Position accuracy	Approx. 10m, 95% of the time, Horizontal dilution of position (HDOP) ≤ 1 *Note: All GPS receiver are subject to degradation of position and velocity accuracies under the U.S. Department of Defence. Position may be degraded.* DGPS: Approx. 5 m, 95% of the time
Tracking velocity	900 kts
Position-fixing time	Warm start: 20 seconds Cold start: 2 minutes
Position update interval	1 second

Display Section

LCD	122 x 92 mm (320 x 240 dot matrix)
Display mode	Plotter modes 1 and 2, Highway, Navigation Data
Display	Mercator projection Track recording capacity: 2,000 pts. Buoy graphic (option) YEOMAN waypoint display
Waypoint storage capacity	999 pts. with comment (12 character)
Route storage capacity	30 routes (30 waypoints per route) Simple route: 1 route/30 waypoints
Event mark storage capacity	99 points
Alarms	Waypoint arrival, Anchor watch, Cross track error, Speed, Trip, Water temperature, Depth

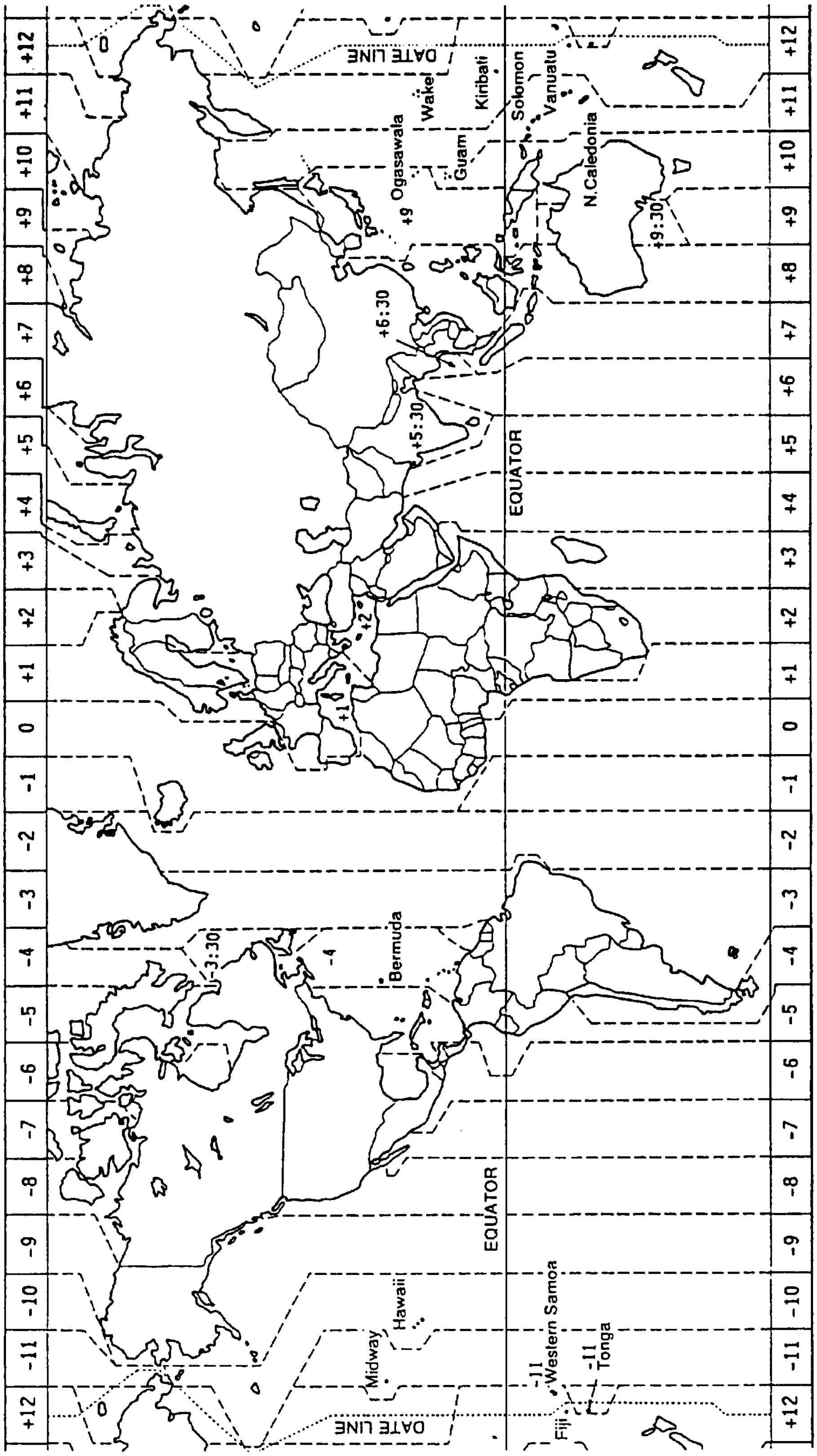
Data Input/Output

Number of ports	4 I/O ports
Input data format	IEC 61162-1/NMEA 0183
Input data	NMEA 0183: AGFPA, DBT, DPT, MTW, TLL DPGS; RTCM SC104 Ver. 2.1 Universal data from personal computer.
Output data	IEC 61162-1/NMEA 0183 (Ver. 1.5/Ver. 2.0): AAM, APA, APB, BOD, BWC, BWR, BWW, GGA, GLL, GNS, RMB, RMC, VTG, WCV, WNC, WNR, WPL, XTE, ZDA, ZLG, ZTG, Rnn, RTE, DTM (IEC 61162-1)

Power Supply & Environmental Conditions

Power supply and power consumption	10.2 to 31.2 V DC, less than 10 W
Useable environment	GPS antenna unit: -25°C to +70°C Display unit:-15°C to +55°C
Humidity	95% (40°C)
Waterproofing specification	GPS antenna unit: IEC 529 1PX6 Display unit: IEC 529 1PX5 (USCG CFR-46)
Resistancy	1 to 12.5 Hz: 3.2 mmpp 12.5 to 2.5 Hz: 0.8 mmpp 25 to 50 Hz: 0.2 mmpp

World Time Standards



Geodetic Chart List

001:	WGS84	
002:	WGS72	
003:	TOKYO	: Mean Value (Japan, Korea & Okinawa)
004:	NORTH AMERICAN 1927	: Mean Value (CONUS)
005:	EUROPEAN 1950	: Mean Value
006:	AUSTRALIAN GEODETIC 1984	: Australia & Tasmania
007:	ADINDAN	: Mean Value (Ethiopia & Sudan)
008:		: Ethiopia
009:		: Mali
010:		: Senegal
011		: Sudan
012:	AFG	: Somalia
013:	AIN EL ABD 1970	: Bahrain Is.
014:	ANNA 1 ASTRO 1965	: Cocos Is.
015:	ARC 1950	: Mean Value
016:		: Botswana
017:		: Lesotho
018:		: Malawi
019:		: Swaziland
020:		: Zaire
021:		: Zambia
022:		: Zimbabwe
023:	ARC 1960	: Mean Value (Kenya & Tanzania)
024:		: Kenya
025:		: Tanzania
026:	ASCENSION IS. 1958	: Ascension Is.
027:	ASTRO BEACON “E”	: Iwo Jima Is.
028:	ASTRO B4 SOR. ATOLL	: Tern Is.
029:	ASTRO POS 71/4	: St. Helena Is.
030:	ASTRONOMIC STATION 1952	: Marcus Is.
031:	AUSTRALIAN GEODETIC 1966	: Australia & Tasmania
032:	BELLEVUE (IGN)	: Efate & Erromango Islands
033:	BERMUDA 1957	: Bermuda Islands
034:	BOGOTA OBSERVATORY	: Columbia
035:	GAUPO INCHAUSPE	: Argentina
036:	CANTON IS. 1966	: Phoenix Islands
037:	CAPE	: South Africa
038:	CAPE CANAVERAL	: Mean Value (Florida & Bahama Islands)
039:	CARTHAGE	: Tunisia
040:	CHATHAM 1971	: Chatham Is. (New Zealand)
041:	CHUA ASTRO	: Paraguay
042:	CORREGO ALEGRE	: Brazil
043:	DJAKARTA (BATAVIA)	: Sumatra Is. (Indonesia)
044:	DOS 1968	: Gizo Is. (New Georgia Is.)
045:	EASTER IS. 1967	: Easter Is.
046:	EUROPEAN 1950 (Cont’d)	: Western Europe
047:		: Cyprus
048:		: Egypt
049:		: England, Scotland, Channel & Shetland Islands
050:		: England, Ireland, Scotland, & Shetland Islands
051:		: Greece
052		: Iran
053:		: Italy, Sardinia
054:		: Italy, Sicily
055:		: Norway & Finland
056:		: Portugal & Spain
057:	EUROPEAN 1979	: Mean Value
058:	GANDAJIKA BASE	: Republic of Maldives
059:	GEODETIC DATUM 1949	: New Zealand
060:	GUAM 1963	: Guam Is.
061:	GUX 1 ASTRO	: Guadalcanal Is.
062:	HJORSEY 1955	: Iceland
063:	HONG KONG 1363	: Hong Kong
064:	INDIAN	: Thailand & Vietnam
065:		: Bangladesh, India & Nepal
066:	IRELAND 1965	: Ireland
067:	ISTS 073 ASTRO 1969	: Diego Garcia
068:	JOHNSTON IS. 1961	: Johnston Is.
069:	KANDAWALA	: Sri Lanka
070:	KERGUELEN IS.	: Kerguelen Is.
071:	KERTAU 1948	: West Malaysia & Singapore
072:	LA REUNION	: Mascarene Is.
073:	L. C. 5 ASTRO	: Cayman Brac Is.
074:	LIBERIA 1964	: Liberia
075:	LUZON	: Philippines (excl. Mindanao Is.)
076:		: Mindanao Is.
077:	MAHE 1971	: Mahe Is.
078:	MARCO ASTRO	: Salvage Islands
079:	MASSAWA	: Eritrea (Ethiopia)
080:	MERCHICH	: Morocco
081:	MIDWAY ASTRO 1961	: Midway Is.
082:	MINNA	: Nigeria
083:	NAHRWAN	: Masirah Is. (0man)
084:		: United Arab Emirates
085:		: Saudi Arabia
086:	NAMIBIA	: Namibia
087:	MAPARIMA, BWI	: Trinidad & Tobago
088:	NORTH AMERICAN 1927	: Western United States
089:		: Eastern United States
090:		: Alaska
091:		: Bahamas (excl. San Salvador Is.)
092:		: Bahamas, San Salvador Is.
093:		: Canada (incl. Newfoundland Is.)
094:		: Alberta & British Columbia
095:		: East Canada
096:		: Manitoba & Ontario
097:		: Northwest Territories & Saskatchewan
098:		: Yukon
099:		: Canal Zone
100:		: Caribbean
101:		: Central America
102:		: Cuba
103:		: Greenland
104:		: Mexico
105:	NORTH AMERICAN 1983	: Alaska
106:		: Canada
107:		: CONUS
108:		: Mexico, Central America
109:	OBSERVATORIO 1966	: Corvo & Flores Islands (Azores)
110:	OLD EGYPTIAN 1930	: Egypt
111:	OLD HAWAIIAN	: Mean Value
112:		: Hawaii
113:		: Kauai
114:		: Maui
115:		: Oahu
116:	OMAN	: Oman
117:	ORDNANCE SURVEY OF GREAT BRITAIN 1936	: Mean Value
118:		: England
119:		: England, Isle of Man & Wales
120:		: Scotland, & Shetland Islands
121:		: Wales
122:	PICO DE LAS NIVIES	: Canary Islands
123:	PITCAIRN ASTRO 1967	: Pitcairn Is.
124:	PROVISIONS SOUTH CHILEAN 1963	: South Chile (near 53˚ S)
125:	PROVISIONAL SOUTH AMERICAN 1956	: Mean Value
126:		: Bolivia
127:		: Chile-Northern Chile (near 19˚S)
128:		: Chile-Southern Chile (near 43˚S)
129:		: Columbia
130:		: Ecuador
131:		: Guyana
132:		: Peru
133:		: Venezuela
134:	PUERTO RICO	: Puerto Rico & Virgin Islands
135:	QATAR NATIONAL	: Qatar
136:	QORNOQ	: South Greenland
137:	ROME 1940	: Sardinia Islands
138:	SANTA BRAZ	: Sao Maguel, Santa Maria Islands (Azores)
139:	SANTO (DOS)	: Espirito Santo Is.
140:	SAPPER HILL 1943	: East Falkland Is.
141:	SOUTH AMERICAN 1969	: Mean Value
142:		: Argentina
143:		: Bolivia
144:		: Brazil
145:		: Chile
146:		: Columbia
147:		: Ecuador
148:		: Guyana
149:		: Paraguay
150:		: Peru
151:		: Trinidad & Tobago
152:		: Venezuela
153:	SOUTH ASIA	: Singapore
154:	SOUTHEAST BASE	: Porto Santo & Madeira Islands
155:	SOUTHWEST BASE	: Faial, Graciosa, Pico, Sao Jorge, & Terceira Is.
156:	TIMBALAI 1948	: Brunei & East Malaysia (Sarawak & Sadah)
157:	TOKYO	: Japan
158:		: Korea
159:		: Okinawa
160:	TRISTAN ASTRO 1968	: Tristan da Cunha
161:	VITI LEVU 1916	: Viti Levu Is. (Fiji Islands)
162:	WAKE-ENIWETOK 1960	: Marshall Islands
163:	ZANDERIJ	: Surinam
164:	BUKIT RIMPAH	: Bangka & Belitung Islands (Indonesia)
165:	CAMP AREA ASTRO	: Camp Mcmurdo Area, Antarctica
166:	G. SEGARA	: Kalimantan Is. (Indonesia)
167:	HERAT NORTH	: Afghanistan
168:	HU-TZU-SHAN	: Taiwan
169:	TANANARIVE OBSERVATORY 1925	: Madagascar
170:	YACARE	: Uruguay
171:	RT-90	: Sweden
172:	Pulkovo 1942	: Russia
173:	Finish KKJ	: Finland

Loran C Chains

Chain	GRI	S1	S2	S3	S4	S5
Central Pacific	4990	11	29	--	--	--
Canadian East Coast	5930	11	25	38	--	--
Command Lion (Korea)	5970	11	31	42	--	--
Canadian West Coast	5990	11	27	41	--	--
South Saudi Arabia	7170	11	26	39	52	--
Labrador Sea	7930	11	26	--	--	--
Eastern Russia	7950	11	30	46	61	--
Gulf of Alaska	7960	11	26	44	--	--
Norwegian Sea	7970	11	26	46	60	--
Southeast USA	7980	11	23	43	59	--
Mediterranean Sea	7990	11	29	47	--	--
Western Russia	8000	11	25	50	65	--
North Central USA	8290	11	27	42	--	--
North Saudi Arabia	8990	11	25	40	56	69
Great Lakes	8970	11	28	44	59	--
South Central USA	9610	11	25	40	52	65
West Coast USA	9940	11	27	40	--	--
Northeast USA	9960	11	25	39	54	--
Northeast Pacific (old)	9970	11	30	55	81	--
Icelandic	9980	11	30	--	--	--
North Pacific	9990	11	29	43	--	--
Suez	4991	10	24			
England, France	8940	12	30			
Northwest Pacific	8930	11	30	50	70	
Newfoundland East Coast	7270	11	25			
Lessay	6731	10	39			
BØ	7001	11	27			
Sylt	7499	11	26			
Ejde	9007	10	23	38		
Saudia Arabia North	8830	11	25	39	56	
Saudia Arabia South	7030	11	25	37	55	

Decca Chains

Chain No.	Chain	Chain code	Location
01	South Baltic	0A	Europe
02	Vestlandet	0E	"
03	Southwest British	1B	"
04	Northumbrian	2A	"
05	Holland	2E	"
06	North British	3B	"
07	Lofoten	3E	"
08		3F	"
09	North Baltic	4B	"
10	North West	4C	"
11	Trondelag	4E	"
12	English	5B	"
13	North Bothnian	5F	"
14	Southern Spanish	6A	"
15	North Scottish	6C	"
16	Gulf of Finland	6E	"
17	Danish	7B	"
18	Irish	7D	"
19	Finnmark	7E	"
20	French	8B	"
21	South Bothnian	8C	"
22	Hebridean	8E	"
23	Frisian Islands	9B	"
24	Helgeland	9E	"
25	Skagerrak	10B	"
26	North Persian Gulf	5C	Persian Gulf & India
27	South Persian Gulf	1C	"
28	Bombay	7B	"
29	Calcutta	8B	"
30	Bangladesh	6C	"
31	Saliyah	2F	"
32	Hokkaido	9C	Japan
33	Tohoku	6C	"

Chain no.	Chain	Chain code	Location
34	Kanto	8C	Japan
35	Shikoku	4C	"
36	Hokuriku	2C	"
37	Kita Kyushu	7C	"
38	Namaqualand	4A	Southern Africa
39	Cape	6A	"
40	Eastern Province	8A	"
41	South West Africa	9C	"
42	Natal	10C	"
43	Dampier	8E	Australia
44	Port Headland	4A	"
45	Anticosti	9C	Northern Africa
46	East Newfoundland	2C	"
47	Cabot Strait	6B	"
48	Nova Scotia	7C	"

DGPS Reference Station List

Country	Location	ID No.	Freq. (kHz)	Lat/Long	Baud rate
Belgium	OOSTENDEPHARE		312.0	51°14'N/02°55'E	100
Denmark	HAMMERODDE	0451	289.0	55°18'N/14°46'E	100
	SKAGEN	0452	298.0	57°44'N/10°35'E	100
	BLAAVANDS HUK	0453	296.5	55°34'N/08°05'E	100
Great Britain	ST. CATHERINE'S POINT	0020	293.5	50°34'N/01°17'W	100
	LIZARD	0001	284.0	49°57'N/05°12'W	100
	POINT LYNAS		304.5	53°24'N/04°17'W	100
	RHINNS OF ISLAY		293.5	55°40'N/06°31'W	100
	BUTT OF LEWIS		289.5	58°31'N/06°16'W	100
	SUMBURGH HEAD		304.5	59°51'N/01°16'W	100
	GIRDLE NESS		311.5	57°08'N/02°03'W	100
	FLAMBOROUGH HEAD	0039	302.5	54°06'N/00°04'W	100
	NORTH FORELAND	0054	310.5	51°22'N/01°26'W	100
Finland	PORKKALA	0400	285.0	59°58'N/24°24'E	100
	MANTYLUOTO	0401	298.0	61°36'N/21°28'W	100
	OUTOKUMPU		293.5	62°52'N/27°40'E	100
	PUUMALA		301.5	61°33'N/27°30'E	100
France	GATTEVILLE		297.5	49°42'N/01°16'W	100
	ECKMUHL		312.5	47°48'N/04°23'W	100
	LES BALEINES		299.5	46°15'N/01°34'W	100
	CAP FERRET		287.0	44°39'N/01°15'W	100
	CAP BEAR		313.0	42°31'N/03°08'E	100
	REVELLATA		294.5	42°35'N/08°44'E	100
Germany	WUSTROW	0491	314.5	54°20'N/12°23'E	200
	HELGOLAND	0492	313.0	54°11'N/07°53'E	200
Netherlands	AMELAND		299.5	53°27'N/05°38'E	100
	HOEK VAN HOLLAND		287.5	51°59'N/04°07'E	100
Iceland	REYKJANES	0001	292.5	63°49'N/22°42'W	100
	BJARGTANGAR	0002	289.0	65°30'N/24°32'W	100
	SKAGATA	0003	304.5	66°07'N/20°06'W	100

Country	Location	ID No.	Freq. (kHz)	Lat/Long	Baud rate
Iceland	RAUFARHOFN	0004	301.5	66°27'N/15°57'W	100
	DJUPIVOGUR	0005	295.5	64°39'N/15°17'W	100
	SKARDSFJARA	0006	313.0	63°31'N/17°59'W	100
Ireland	MIZEN HEAD		300.5	51°27'N/09°49'E	100
	TORY ISLAND		313.5	55°16'N/08°15'E	100
Latvia	VENTSPILS		308.5	57°22'N/21°31'E	100
Norway	FAERDER	0101	288.0	59°01'N/10°31'E	100
	UTSIRA	0201	307.0	59°18'N/04°52'E	100
	UTVAER	0203	300.0	61°02'N/04°30'E	100
	SVINOEY	0204	293.5	62°19'N/05°16'E	100
	HALTEN	0206	313.5	64°10'N/09°24'E	100
	SKOMVAER	0302	300.0	67°24'N/11°52'E	100
	TORUNGEN	0102	292.5	58°23'N/08°48'E	100
	LISTA	0104	301.0	58°06'N/06°34'E	100
	SKLINNA	0207	288.5	65°12'N/10°59'E	100
	TORSVAAG	0305	291.5	70°14'N/19°30'E	100
	HELNES	0307	288.5	71°03'N/26°13'E	100
	VARDOE	0309	307.0	70°23'N/31°09'E	100
	BELLSUND	0401	292.5	77°43'N/13°57'E	100
Russia	BALTIYSK		298.5	54°41'N/19°59'E	100
Spain	CABO FINISTERRE		298.0	42°53'N/09°16'W	100
	CABO GATA		298.5	36°43'N/02°11'W	100
	PUNTA DE CALA FIGUERA		286.0	39°27'N/02°31'E	100
Sweden	BJUROKLUBB	0461	303.5	64°29'N/21°35'E	100
	SKAGS UDDE	0462	306.5	63°11'N/19°01'E	100
	OSKAR	0463	291.5	60°32'N/18°23'E	
	ALMAGRUNDET	0464	287.0	59°09'N/19°10'E	100
	HOBURG	0465	302.0	56°55'N/18°09'E	100
	KULLEN	0466	293.5	56°18'N/12°27'E	100
	HJORTONS UDDE	0467	297.0	58°38'N/12°40'E	200
United States of America	WHITEFISH PT, MI		318.0	46°46'N/84°57'W	100
	DULUTH, MN		296.0	46°47'N/92°05'W	100

Country	Location	ID No.	Freq. (kHz)	Lat/Long	Baud rate
United States of America	UPPER KEWEENAW, MI		298.0	47°14'N/88°38'W	100
	NEEBISH IS, MI		309.0	46°19'N/84°09'W	200
	SEUL CHOIX PT, MI		322.0	45°55'N/85°55'W	200
	PRESQUE ILE, MI		293.0	45°21'N/83°30'W	100
	SAGINAW, MI		301.0	44°15'N/83°27'W	100
	MILWAUKEE, WI		298.0	43°02'N/87°53'W	100
	DETROIT, MI		319.0	42°18'N/83°06'W	200
	BUFFALO, NY		322.0	42°52'N/78°54'W	100
	PORTSMOUTH, NH	0003	288.0	43°04'N/70°43'W	100
	MONTAUK PT, NY	0002	293.0	41°04'N/71°52'W	100
	WILDWOOD, NJ	1008	301.0	38°57'N/74°52'W	100
	WILDWOOD, NJ	1007	301.0	38°57'N/74°52'W	100
	CAPE HENLOPEN, DE	0001	298.0	38°47'N/75°05'W	100
	ALEXANDRIA, VA		305.0	38°45'N/77°07'W	100
	CAPE HENRY, VA	0004	289.0	36°56'N/76°00'W	100
	BASS HARBOR, ME		316.0	44°13'N/68°20'W	100
	CHATHAM, MA		304.0	41°40'N/69°57'W	200
	SANDY HOOK, NJ	0008	286.0	40°28'N/74°00'W	200
	FORT MACON, NC		294.0	34°42'N/76°41'W	100
	CHARLESTON, SC		298.0	32°45'N/79°51'W	100
	CAPE CANAVERAL, FL		289.0	28°28'N/80°33'W	100
	EGMONT KEY, FL		312.0	27°36'N/82°46'W	100
	MIAMI, FL		322.0	25°44'N/80°10'W	100
	KEY WEST, FL		286.0	24°xx'N/82°xx'W	100
	SAN JUAN, PR		295.0	18°xx'N/66°xx'W	100
	ENGLISH TURN, LA		293.0	29°53'N/89°56'W	200
	GALVESTON, TX		296.0	29°20'N/94°44'W	100
	ARKANSAS PASS, TX		304.0	27°50'N/97°04'W	100
	MOBILE PT, AL		300.0	30°14'N/88°01'W	100
	WHIDBEY IS, WA	0276	302.0	48°19'N/122°42'W	100
	ROBINSON PT, WA	0274	323.0	47°23'N/122°22'W	200
	C. MENDOCINO, CA		292.0	40°26'N124°24'W	100

Country	Location	ID No.	Freq. (kHz)	Lat/Long	Baud Rate
United States of America	PIGEON PT, CA		287.0	37°11'N/122°24'W	100
	PT BLUNT, CA		310.0	37°51'N/122°25'W	200
	PT ARGUELLO, CA		321.0	34°35'N/120°39'W	100
	PT LOMA, CA		302.0	32°40'N/117°15'W	100
	CAPE HINCHENBROOK, AK		292.0	60°14'N/146°39'W	100
	POTATO PT, AK		298.0	61°04'N/146°42'W	100
	NIKISHKA, AK		310.0	60°44'N/151°22'W	100
	CAPE CHINIAK, AK		313.0	57°37'N/152°10'W	100
	COLD BAY, AK		289.0	55°18'N/162°47'W	100
	YAKUTAR, AK			59°33'N/139°44'W	100
	HAINES, AK			59°13'N/135°26'W	100
	GUSTAVUS, AK			58°26'N/135°42'W	100
	BIORKA IS, AK			56°51'N/135°32'W	100
	LEVEL IS, AK			56°28'N/133°06'W	100
	ANNETTE IS, AK			55°04'N/131°37'W	100
	BARBERS POINT		325.0	21°18'N/158°07'W	100
	UPOLO PT, HI		285.0	21°15'N/155°53'W	100
	KOKOLE PT, HI			21°59'N/159°46'W	100
	VICKSBURG, MS	0800	313.0		200
	MEMPHIS, TN		310.0		200
	ST LOUIS, MO		322.0		200
Canada	POINT PATRIE		303.0	43°50'N/77°07'W	100
	PORT WELLER		302.0	43°14'N/79°13'W	100
	SOMBRA		306.0	42°42'N/82°29'W	100
	TROIS RIVIERES		321.0	46°24'N/72°27'W	100
	LAUZON		314.0	46°48'N/71°09'W	100
	ST JEAN SUR RICHELIEU		308.0	45°20'N/73°20'W	100
	PARTRIDGE ISLAND		311.0	45°14'N/66°03'W	100

Country	Location	ID No.	Freq. (kHz)	Lat/Long	Baud Rate
Canada	WESTERN HEAD		296.0	43°59'N/64°39'W	100
	CAPE RACE		288.0	46°39'N/53°04'W	100
	PORT AUX BASQUES			47°34'N/59°09'W	100
	CAPE SPEAR		314.5	47°31'N/52°37'W	100
	TRIPLE ISLAND, B.C.	0909	308.0	54°17'N/130°53'W	100
	POINT ATKINSON, B.C.	0902	320.0	49°20'N/123°15'W	100
	RACE ROCKS, B.C.		309.0	48°18'N/123°31'W	100
Bermuda	ST. DAVID'S HEAD		323.0	32°22'N/64°39'W	100
Brazil	PONTA DE SAO MARCOS		300.5	02°29'N/44°18'W	100

Glossary

Almanac

Each GPS satellite broadcasts its own orbital data as well as general orbital data of all other GPS satellites. This general orbital data is called the Almanac. The GPS receiver receives the Almanac and decodes it to calculate the quantity and elevation angle of satellites in view, to know when it can receive the GPS signal. If there is no Almanac in the receiver it cannot fix its position. The receiver is shipped with no Almanac, thus when it is turned on for the first time it starts receiving the Almanac. Each time the unit is turned on the previous Almanac is erased and the latest received.

Beacon receiver

The DGPS (Differential GPS) station transmits a beacon signal which contains information about GPS error. The device which receives the beacon signal is called a beacon receiver.

Cold start

When the GPS receiver is turned on for the very first time, it starts receiving the Almanac. This condition is called cold start. In this condition it takes about two minutes to find position. Once the Almanac is stored in the GPS navigator, it takes only about 20 seconds to find position. (The normal start-up condition is called warm start.)

Destination

A destination can be either a single destination waypoint or a series of waypoints leading to the ultimate destination. When you set a destination, the GPS receiver provides range and bearing data to the destination, to help you steer to the destination along the shortest past possible.

Differential GPS (DGPS)

The differential GPS system, consisting of DGPS land stations and DPGS beacon receiver-equipped marine vessels, further refines the accuracy of the GPS measured position.
A DGPS land station knows its exact position. If there is a difference between GPS position and DGPS land station's position this is called GPS error. The DPGS station transmits GPS error data to a beacon receiver which relays the data to the GPS receiver. The GPS receiver uses this data to refine the accuracy of the GPS position (within about 10 meters under ideal conditions).
DGPS stations are strategically located throughout America (including Hawaii and Alaska), Europe, Canada, Bermuda and Brazil.

Estimated time of arrival (ETA)

The time at which you arrive at the ultimate destination.

Geodetic chart

A nautical chart is usually made by either trigonometrical survey or astronomical survey and according to the geodetic chart standards of the country where it is used. The GPS standard chart system is WGS-84.
Thus if you are using a chart different from WGS-84, there will be error between GPS position and nautical chart position. To get correct position, the GPS receiver must know what chart system you are using, to apply an offset to GPS position.

GPS measured position

GPS measured latitude and longitude position.

Intermediate waypoint

A waypoint in a route.

Magnetic bearing

Bearing relative to magnetic north, with the compass bearing corrected for deviation.

Magnetic variation offset

The location of the magnetic north pole is different from the geographical north pole. This causes a difference between the true and magnetic north direction. This difference is called magnetic variation, and varies with respect to the observation point on the earth. This variation may be entered automatically or manually.

Navigation calculation

The GPS receiver calculates the range, bearing and cross track error to next waypoint when you select a destination. The calculation of that data is called navigation calculation. The calculation itself is done using one of two methods (selectable): Great circle (straight line between two points) or Rhumb line (straight line between two points on nautical chart).

NMEA 0183

The National Marine Electronics Association's signal format which enables connection of electronic equipment of different marine electronics manufacturers.

Plotting interval

The plotting interval determines both how the track will be reconstructed on the display and track storage time. The shorter the interval the more accurate the reconstruction of track line, however total storage time is reduced. The plotting interval can be selected to time or distance. Plotting by distance offers the advantage that the track is not stored when the vessel is anchored.

Route

A series of waypoints leading to the ultimate destination.

Route navigation

Following a stored route.

S/A

GPS was developed by the US Department of Defense mainly for use by its marine vessels and aircraft. For civil users the accuracy of the system is purposely downgraded for national security reasons. This intentional accuracy reduction is called S/A. Because GPS position error may be greater than 100 meters any GPS position should be double checked against other sources to confirm position.

Skip

This means to bypass a waypoint in a route.

Storage capacity

Storage capacity defines how many points of track and marks a memory can hold. The GP-80's storage capacity is 2,000 points.

Time-to-go (TTG)

The amount of time necessary to get to a destination, maintaining current speed and course.

Time differences

Time differences (or TDs) are the position information generated by the Loran C and Decca position-fixing systems. TDs are the time in microseconds between the transmission of pulsed signals in the Loran C and Decca systems.

Total distance

Total distance is the number of miles from starting point to end point in a route.

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Specifications

Input port	2 ports for NMEA 0183 data
Output port	6 ports for either of NMEA 0183 or RS-422 data 3 ports for alarm signal
Power supply	10 to 35 VDC
Power consumption	2.2 W maximum
Color	2.5G5/1.5 Newtone no. 5
Ambient temperature	-15°C to +55°C
Humidity	Relative humidity 95% at +40°C
Waterproofing	None

Installation

Mounting considersations

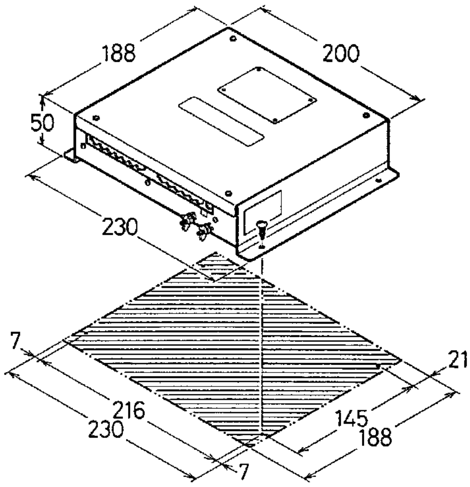
The installation site is important for proper operation and continued performance. Select it keeping the following points in mind.

- **The unit is not waterproof;** locate it away from water spray.
- Select a clean and cool place.
- Select a place where shock,vibration and electrical noise are minimal.
- Leave sufficient space at the sides and rear of the unit for maintenance and service.

Mounting

The unit can be mounted on a bulkhead, overhead or tabletop.

Secure the unit to mounting location with woodscrews. For added support, use nuts, bolts and washers instead of woodscrews.



- All dimensions in millimeters.
- For added support, use nuts, bolts and washers instead of woodscrews.
- Leave sufficient space at the sides and rear of the unit for maintenance and servicing.

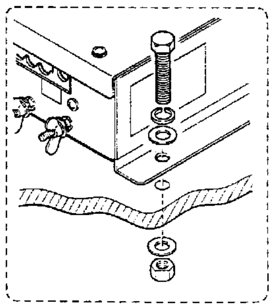


Figure B-1 Interface unit mounting dimensions

Cable fabrication

1) Remove the outer sheath, armor, and shield as illustrated.
2) Remove the insulation of cores 3 mm.
3) Cut and solder unused cores to the shield.
4) Solder a ground wire to the shield.
5) Dress the shield and the outer sheath with heat shrink tube, leaving 30 mm of shield and outer sheath exposed.
6) Heat the heat shrink tube.
7) Remove the insulation of NH connector (supplied) 3 mm.
8) Heat the heat shrink tube.

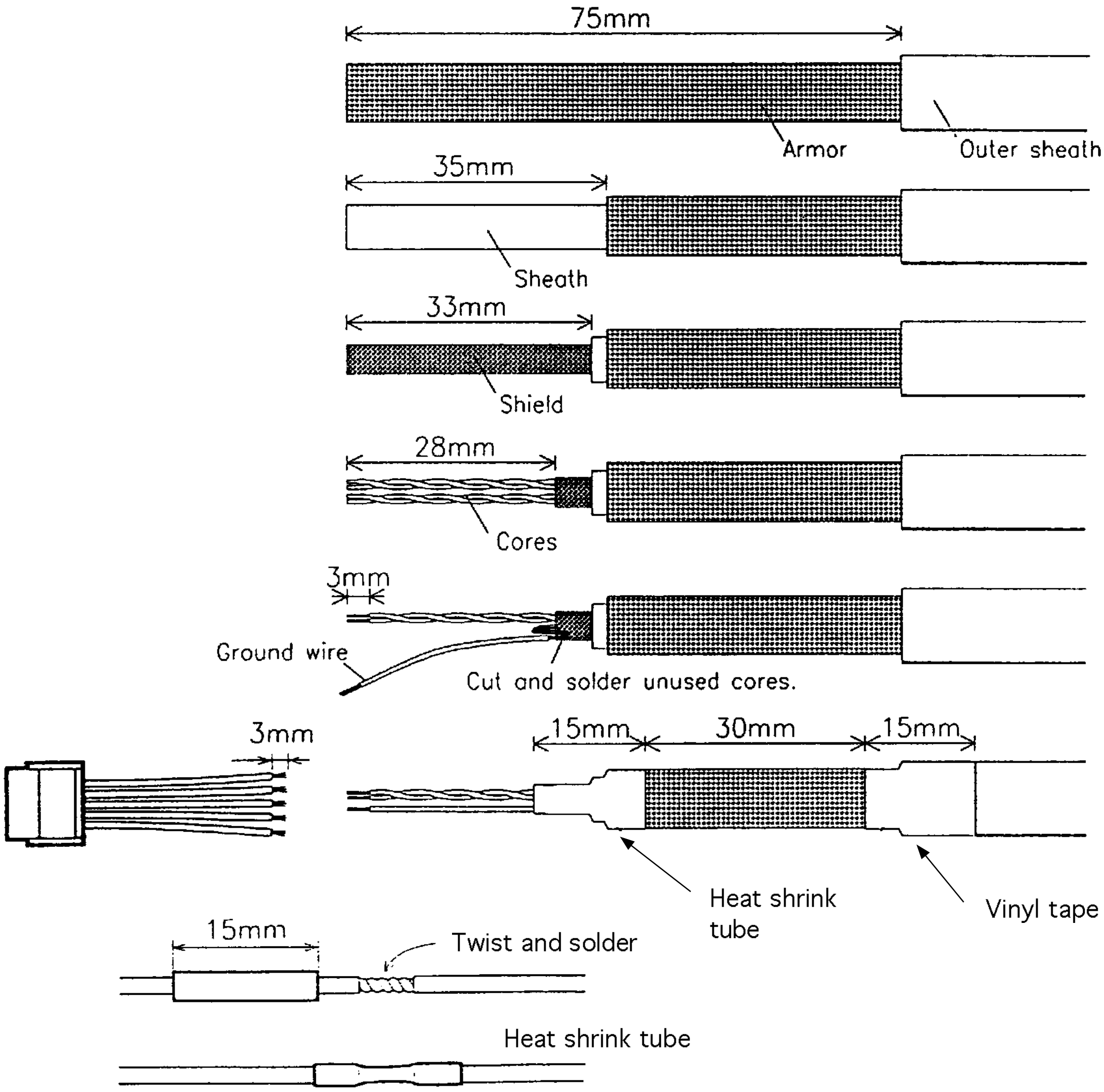


Figure B-2 How to fabricate the signal cable

Grounding

To prevent electrical shock and mutual interference, run a ground wire between the earth terminal on the unit and ship's superstructure.

Cabling schedules

The signal cable should be a twisted-pair, double-screened cable. Ground the signal cable at the cable clamp.

Connections

Power supply

J1 (10 to 35 VDC)

Pin no.	Designation
#1	+
#2	–

Input signal (NMEA)

The signal from DGPS is connected to J2 and J3. Data being fed to J2 has higher priority than J3.

J2		J3	
Pin no.	Designation	Pin no.	Designation
#3	NMEA RD1-H	#3	NMEA RD2-H
#4	NMEA RD1-C	#4	NMEA RD2-C
#6	GND	#6	GND

Output signal (RS-422 or NMEA)

J4, J5, J6, J7, J8, J9

Pin no.	Designation
#1	TD-H
#2	TD-C
#4	GND

Output signal (contact closure signal)

J10 (WPT alarm)		J11		J12	
Pin no.	Designation	Pin no.	Designation	Pin no.	Designation
#1	Alarm signal	#1	Alarm signal	#1	Alarm signal
#2	Alarm signal	#2	Alarm signal	#2	Alarm signal
#3	GND	#3	GND	#3	GND

Selection of output data format

The output data format is selectable by changing a jumper block; A for RS-422 and B for NMEA. For example, to select NMEA for J4, change the jumper block from A to B on J401 and J402. Do the same on J5 thru J9.

J10 (WPT alarm)		J11		J12	
Output	Jumper	Output	Jumper	Output.	Jumper
J4	J401/J402 (A)	J5	J501/J502 (A)	J6	J601/J602 (A)
J7	J701/J702 (A)	J8	J801/J802 (A)	J9	J901/J902 (B)

Default of jumper setting is shown in parenthesis.

Maintenance

Fuse replacement

If the fuse blows, find the cause of the problem before replacing it. Do not use a fuse rated more than 0.5A, since it may cause more serious damage to the equipment.

Self test 1

The unit performs an internal self-check in the following sequence each time power is turned on.

1) LEDs CR7 to CR10 blink twice every 2 seconds.
2) ROM and RAM are tested.
3) LED CR13 blinks every second for normal operation. If an error is detected during the test, the corresponding LED is turned on.
   - When CR7 is on, ROM is defective.
   - When CR8 is on, RAM is defective.

Self test 2

The test requires an external loop to check I/O. Follow the steps below to carry out the test.

1) Set the DIP switch #4 of S1 to the ON position.
2) Temporarily disconnect input and output connectors J2 and J4.
3) Solder a jumper block between J2 and J4; #3 and #4 of J2 are connected to #1 and #2 of J4, respectively.

   Jumper block consists of XH-6 pin and 4 pin connectors with two short wires as below.

XH, 6 pin		XH, 4 pin
#3	- - -	#1
#4	- - -	#2

4) Change the jumper block between J2 and J5; J2/J6, J2/J7, J2/J8, J2/J9, J3/J4, J3/J5, J3/J6, J2/J7, J2/J8, J2/J9.

LED status

The LEDs light according to equipment status as follows:

CR2: Lights when receiving NMEA data from J2.
CR3: Lights when sending NMEA data from J3.
CR4: Lights when sending NMEA data from J4 to J9.
CR6: Blinks every second.
CR7: Lights when ROM error is detected, or no signal at J2 for 300 ms.
CR8: Lights when RAM error is detected, or no signal at J3 for 300 ms.
CR9: Lights when SIO error is detected, or NMEA data is input at J2.
CR10: Lights when NMEA data is input at J2.

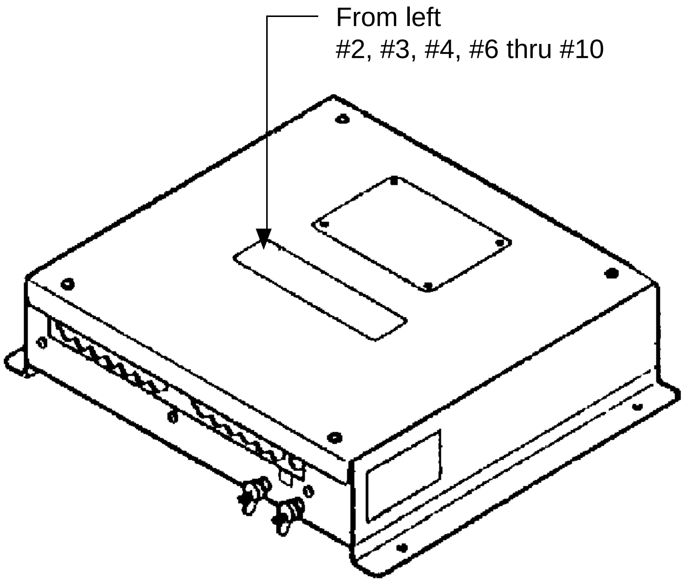


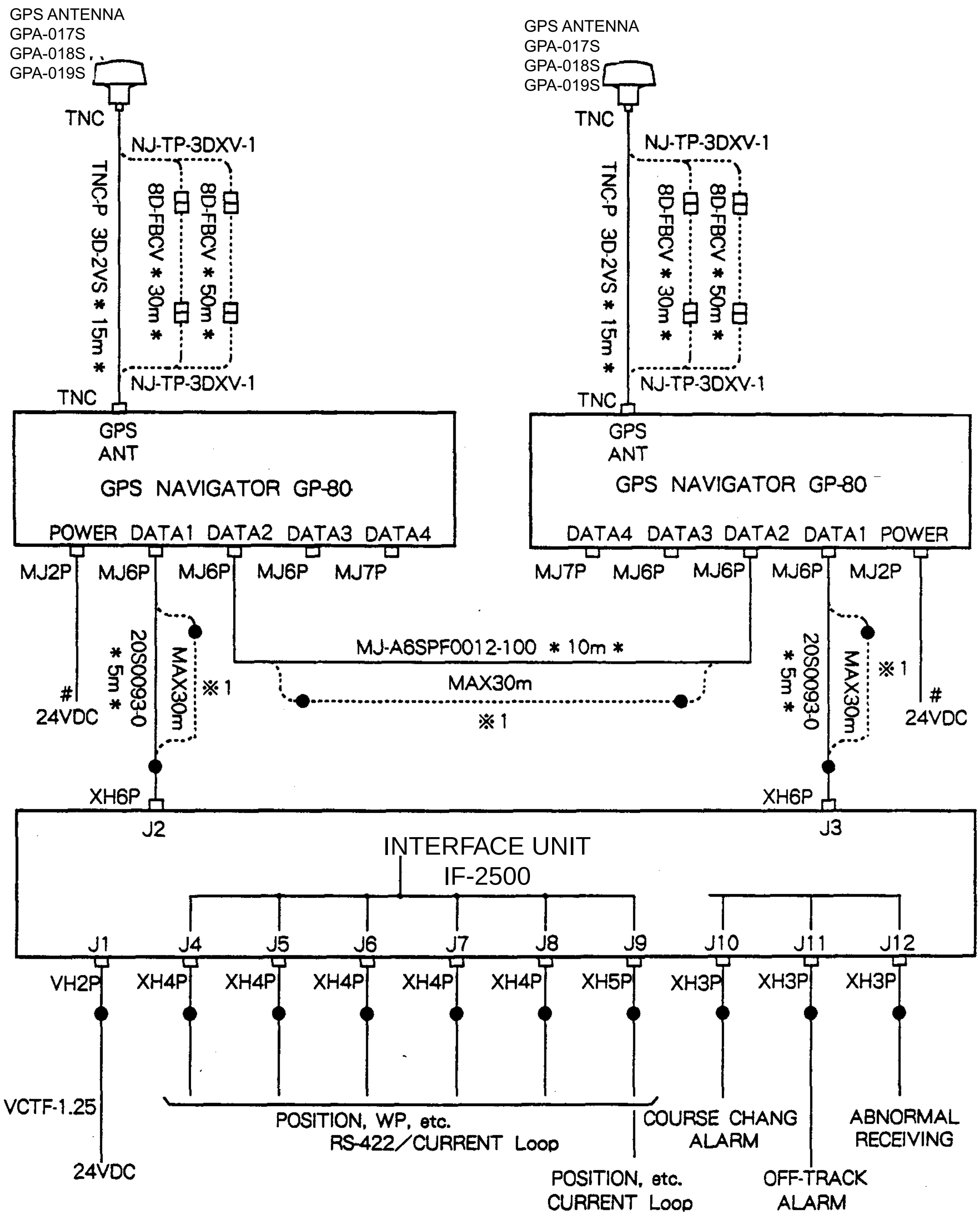
Figure B-3 Location of LEDs

APPENDIX C

INSTALLATION of DD-80

Page

The figure below shows the system configuration of the DD-80.



1) #: MJ-A2SPF004-030 *3m*
2) Cable type is CO-SPEVV-SB-C 2P or equivalent, unless noted otherwise.
3) *1: Interface Unit IF-1422 is required if cable length is more than 30 m.

2. DISPLAY UNIT

The display unit can be installed with either of four methods as shown below. Refer to the outline drawing page D-1, D-2, and D-3.

- Locate the unit away from exhaust pipes and vents.
- The mounting location should be well ventilated.
- Mount the unit where shock and vibration are minimal.
- Keep the display unit away electromagnetic field generating equipment such as motor, generator.
- Allow sufficient maintenance space and a sufficient slack in cables for maintenance and repair.

Table Top and Overhead Mounting

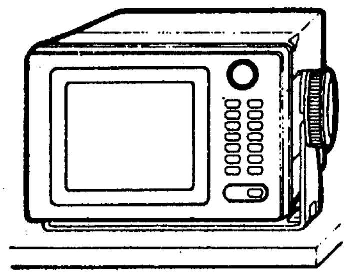
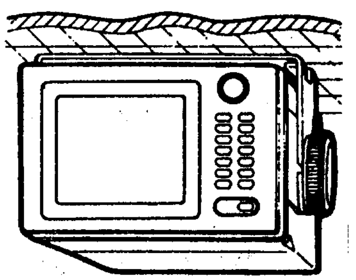


TABLE TOP



OVERHEAD

Display unit mounting methods

Flush mounting type F

An optional flush mount kit type F is required. For details, see outline drawing page D-3.

Name	Type	Code No.
Flush Mount Kit F	OP20-25	004-393-280

Flush mounting type S

An optional flush mount kit type S is required. For details, see outline drawing page D-4.

Name	Type	Code No.
Flush Mount Kit S	OP20-24	004-393-000

3. ANTENNA UNIT

Mounting

Install the antenna unit referring to the installation diagram on page D-4. When selecting a mounting location for the antenna unit, keep in mind the following points.

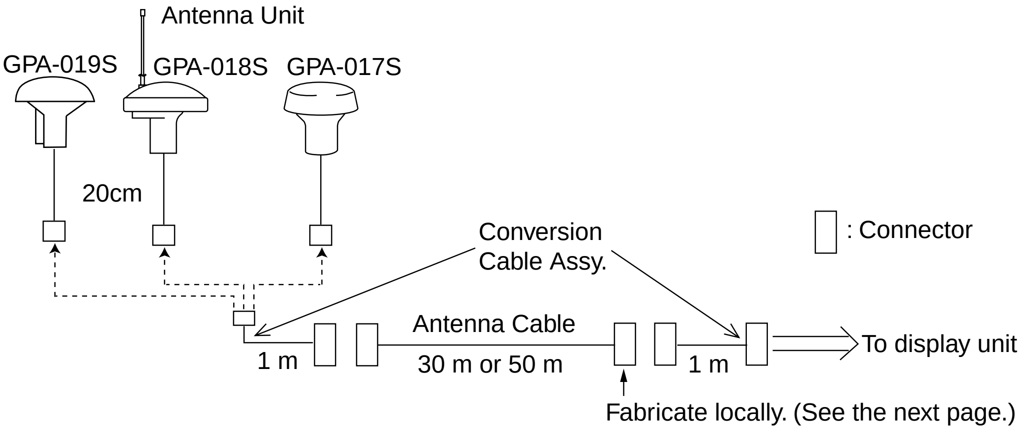
- **Select a location out of the radar beam.** The radar beam will obstruct or prevent reception of the GPS satellite signal.
- **Be sure the location offers a clean line-of-sight to satellite.** Objects within line-of-sight to a satellite, for example, a mast or funnel, block reception and cause prolonged acquiring time or interruption of position fix.
- **Mount the unit as high as possible.** Mounting the antenna as high as possible keeps it free of water spray, which can intercept reception of GPS satellite signal, if water spray is frozen.
- **The antenna unit GPA-018S must be grounded.** Connect ground wire of 1.25 sq or larger (local supply) between unit and a stainless steel screw fastened to the mast.

Extending Antenna Cable Length

The standard cable is 15m long. 30m and 50m long extension cable sets are optionally available.

◆Extension cable line-up

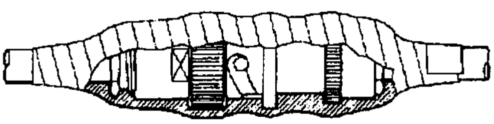
Fabricate the end of antenna cable and attach the coaxial connector. Details are shown on next page.



Extension Cable Line-up

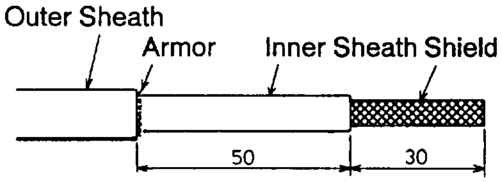
◆Waterproofing the connector

Wrap connector with vulcanizing tape and then vinyl tape. Bind the tape end with cable-tie.

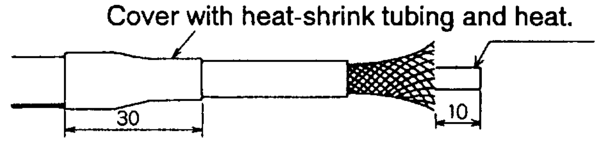


How to waterproof the antenna

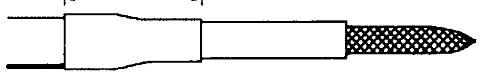
How to attach the N-P-8DFB connector



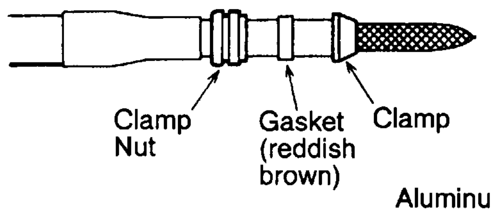
Remove outer sheath and armor by the dimensions shown left.
Expose inner sheath and shield by the dimensions shown left.



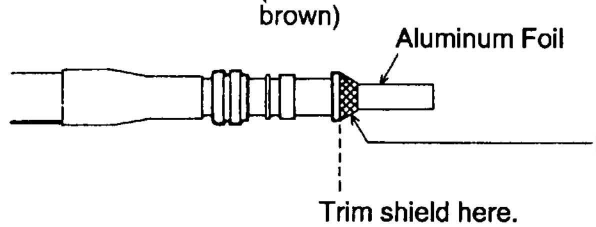
Cut off insulator and core by 10mm.



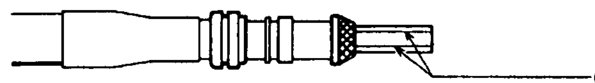
Twist shield end.



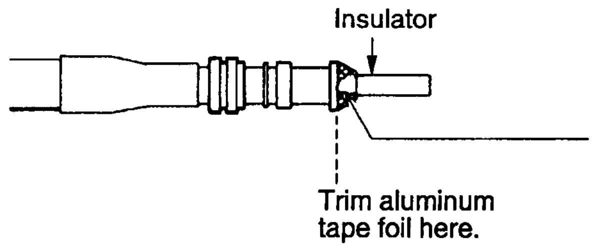
Clip on clamp nut, gasket and clamp as shown left.



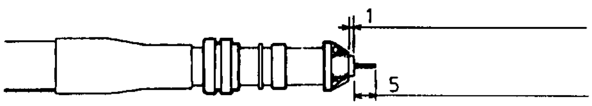
Fold back shield over clamp and trim.



Cut aluminum foil at four places, 90° from one another

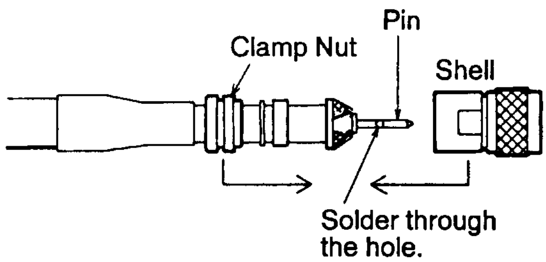


Fold back aluminum foil onto shield and trim.



Expose the insulator by 1mm.

Expose the core by 5mm.



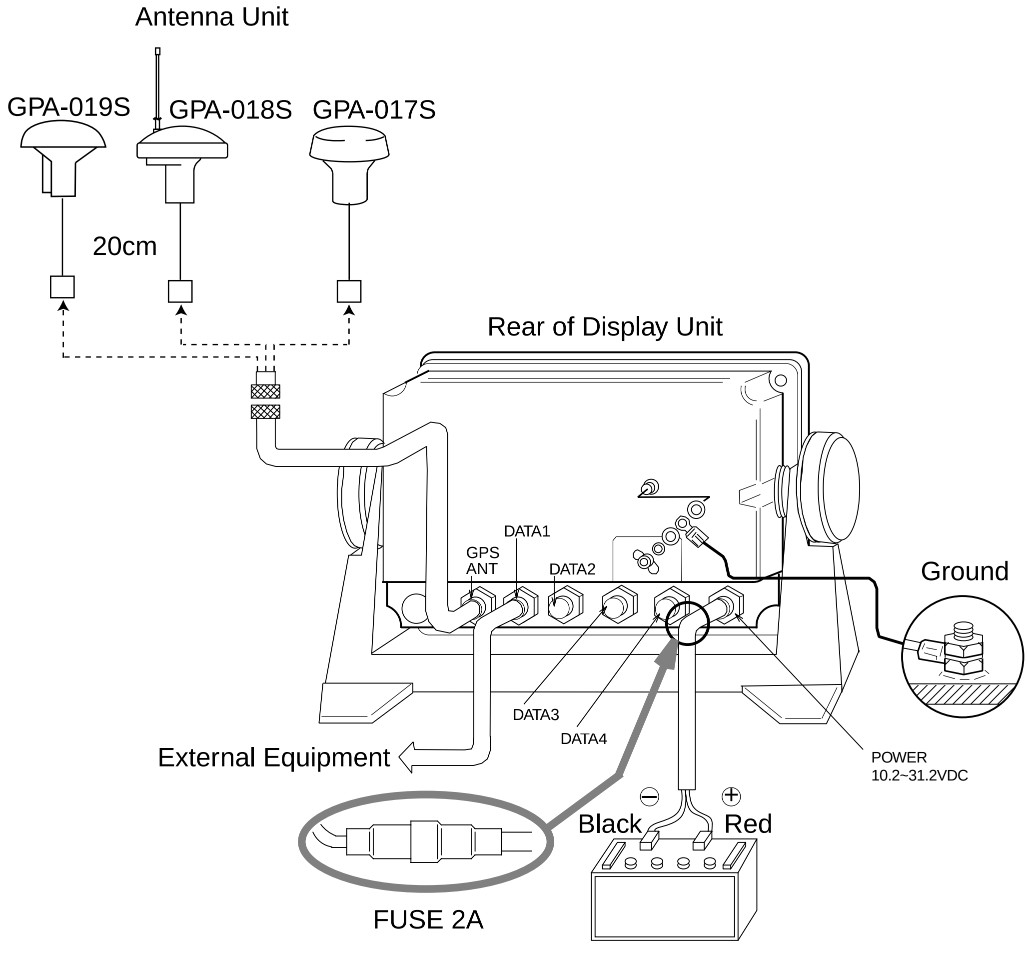
Slip the pin onto the conductor. Solder them together through the hole on the pin.

Insert the pin into the shell. Screw the clamp nut into the shell.
(Tighten by turning the clamp nut. Do not tighten by turning the shell.)

The figure below shows the connection of cables on rear of display unit.

⚠ CAUTION

Ground the receiver to prevent loss of sensitivity and mutual interference.



Connection of cables on display unit

Grounding

The display unit contains several CPUs. While they are operating, they radiate noise, which can interfere with other radio equipment. Ground the unit as follows to prevent it.

- The grounding wire should be 1.25sq or larger.
- The grounding wire should be as short as possible.

5. INITIAL SETTINGS

The DD-80 can output navigation information to external equipment thwough the Interface Unit IF-2500. For example, it can output position data to a radar or echo sounder for display on their display screen.

Before selecting data to output, confirm what data the external equipment requires. Output necessary data only. Outputting unnecessary data can cause receiving problems at the external equipment.

Talker

All data transmitted by marine electronics equipment is prefixed with a two character code which tells external equipment what equipment is transmitting data. This two character code is called the talker. The DD-80 contains the talkers GP, LC and DE.

Because GPS is a relatively new system some early model equipment do not recognize the GP talker name. In this case transmit data using a conventional talker, one the equipment recognizes, such as Loran C.

Data format and data output availability

The type of data which can be transmitted depends on format. Output data sentence of IEC 61162-1 and NMEA 0183 Ver. 1.5/Ver.2.0.

AAM: Waypoint arrival alarm
APB: Autopilot sentence B
magnitude of cross track error, direction to steer, arrival alarm, bearing to waypoint
("Heading to steer to destination waypoint data" not used)
BOD: Bearing-origin to destination
BWC: Bearing and distance to waypoint-great circle
BWR: Bearing and distance to waypoint-rhumb line
BWW: Bearing-waypoint to waypoint
DTM: Datum reference
GGA: Global positioning system (GPS) fix data
time of fix, latitude, longitude, quality indicator, number of satellites in use, DOP, altitude, geoidal separation
("age of dgps data" and "differential reference station ID" not used)
GLL: Geographic position-latitude/longitude

GNS: GNSS fix data
RMB: Recommended minimum navigation information. Cross-track error, direction to steer, origin and destination waypoint latitude and longitude, range and bearing of destination waypoint, destination closing velocity, arrival alarm.
RMC: Recommended minimum specific GPS/TRANSIT data. UTC of position fix, latitude and longitude, ground speed and course, data, magnetic variation
RTE: Routes
VTG: Course over ground and ground speed
WCV: Waypoint closure velocity
WNC: Distance-waypoint to waypoint-great circle
WPL: Waypoint location
XTE: Cross-track error, measured
ZDA: Time and data
ZTG: UTC and time to destination waypoint

Also, the following NMEA 0183 Ver. 1.5 sentences are output

APA: Autopilot sentence "A". Magnitude of cross-track error, direction to steer, arrival alarm, bearing origin to destination.
WNR: Distance-waypoint to waypoint-rhumb line

Input data sentence of NMEA 0183 Ver. 1.5/2.0
Checksum is checked if attached, and if any error is found, the sentence becomes invalid. Talker ID is not distinguished.

DBT: Depth below transducer

$--DBT, 1234.5 f, 1234.5, M, 1234.5 F*12<CR><LF>
a b c d e f g

a, b: Water depth, feet
c, d: Water depth, m
e, f: Water depth, fathoms
g: Checksum

DPT: Depth

$--DPT, 1234.5 1234.5, 1234.5*23<CR><LF>,
a b c

a: Water depth relative to the transducer, meters
b: Offset from transducer, meters… not used
c: Checksum

MTW: Water temperature

$--MTW, 23.4, C*34<CR><LF>
a b c

a: Temperature: degrees, C
c: Checksum

TLL: Target latitude and longitude

$--TLL, 00, 3445.678, N, 13521.234, E, abcd,
121530, T
a b c d d f g
h
R*A5<CR><LF>

a: Target number… not used
b, c: Latitude
d, e: Longitude
f: Target name… not used
g: UTC… not used
h: Target status… not used
i: Reference target… not used
j: Checksum

FURUNO proprietary sentences

AGFPA: Autopilot information from FURUNO autopilot

Port	Input	Output
DATA1, DATA2	NMEA 0183 Ver. 1.5/2.0 AGFPA, DBT, DPT, MTW, TTL	IEC 61162-1/nMEA 0183 Ver. 1.5/2.0 AAM, APA, APB, BOD, BWC, BWR, BWW, GGA, GLL, GNS, RMB, RMC, VTG, WCV< WNC, WNR, WPL, XTE, ZDA, ZTG, Rnn, RTE, DTM
DATA3	External MOB	LOG PULSE
		Same as for DATA1.
DATA4	DGPS or general data (selected through menu)	General data
		IEC 61162-1/nMEA 0183 Ver. 1.5/2.0 AAM, APA, APB, BOD, BWC, BWR, BWW, GGA, GLL, GNS, RMB, RMC, VTG, WCV< WNC, WNR, WPL, XTE, ZDA, ZTG, Rnn, RTE, DTM

General data

1) **Input of lighthouse/buoy information:** Floppy disk stored lighthouse/buoy information is supplied from PC connected to DATA4 port.
2) **Input of waypoint data:** Connect YEOMAN to DATA4 port
3) Input and output of waypoint/route data

Rate of operation

The TX rate or operation is the percentage of data output in one second, and it appears on the screen. If short intervals are assigned to many sentences, the rate of operation increases as illustrated below.



A rate of operation exceeding 100% is impractical. For better performance, the rate of operation should be less than 90%.

DATA1 output setting

1. Press [MENU], [9] and [3] keys to show the DATA1, 3 OUTPUT SETUP menu.

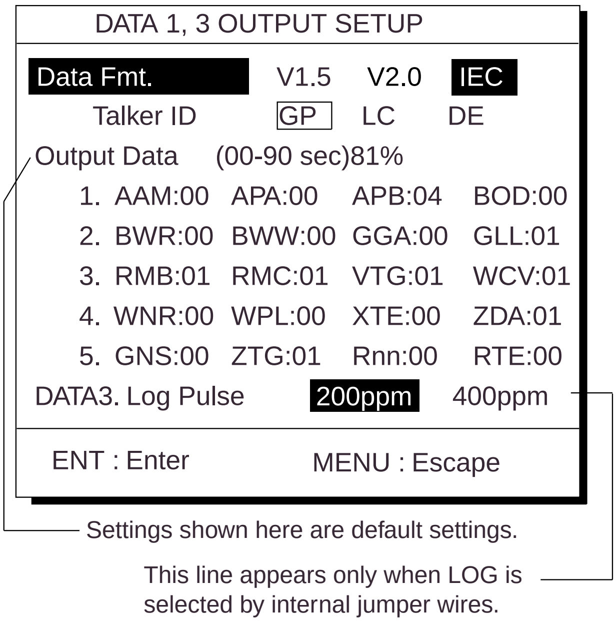


Figure 4-1 DATA1, 3 OUTPUT SETUP menu

2. Press ▲ or ▼ to select DATA FMT
3. Press ◄ or ► to select V1.5, V2.0 or IEC.
4. Press the [ENT] key. Talker ID appears in reverse video.
5. Press ◄ or ► to select GP, LC or DE.
6. Press the [ENT] key.
7. Enter TX interval for each output data sentence in line 1. TX interval is available in 00, 01, 02, 03, 04, 05, 06, 10. 15, 20. 30, 60 and 90 msec.
8. Press the [ENT] key.
9. Enter TX interval for each output data sentence in lines 2 through 5. Press the [ENT] key after setting each line.

In great circle calculation, BWC and WNC are output but BWR and WNR are not. In rhumb line navigation, BWR and WNR are output but BWC and WNC are not.
The total data output are shown by percentage on the third line.
For best results the total output should be less than 90%; lengthen the Tx interval of less important data to make the total output less than 90%.

DATA 3 output setting

The DATA 3 can output NMEA 0183 (V1.5/V2.0) /IEC 61162-1 data or log pulse by selecting inner jumper wire. For NMEA 0183 (V1.5/V2.0) /IEC 61162-1, the same signal of DATA 1 is output from DATA 3.

Selection of NMEA0183 or log pulse

Output data / NAV board	NMEA 0183 (V1.5/ V2.0)/IEC 61162-1	Log pulse
JP4 (2 pcs.)	ON	OFF
JP5 (3 pcs.)	OFF	ON

Rate of log pulse output

500 mA Max.
50 VDC

Procedure for setting of log pulse rate

1) Press [MENU] [9] and [3].
2) Press ▲ or ▼ to select DATA 3. Log Pulse.
3) Press ◀ or ▶ to select log pulse for external equipment; 200ppm or 400ppm.
4) Press the [ENT] key.
5) Press the [ESC] key.

Setting DATA 4 to Data Output

1. Press [MENU], [9] and [5] to show the DATA4 I/O SETUP menu.

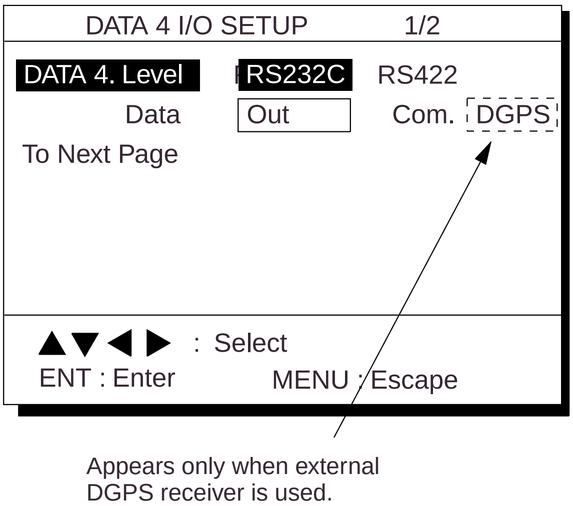


Figure 4-2 DATA4 I/O SETUP menu

2. Press ▲ or ▼ to select Level.
3. Press ◀ or ▶ to select level of external equipment; RS-23C or RS422.
4. Press the [ENT] key.
5. Press ◀ or ▶ to select Out.
6. Press ▼ to go to the next page to show the DATA I/O SETUP menu.

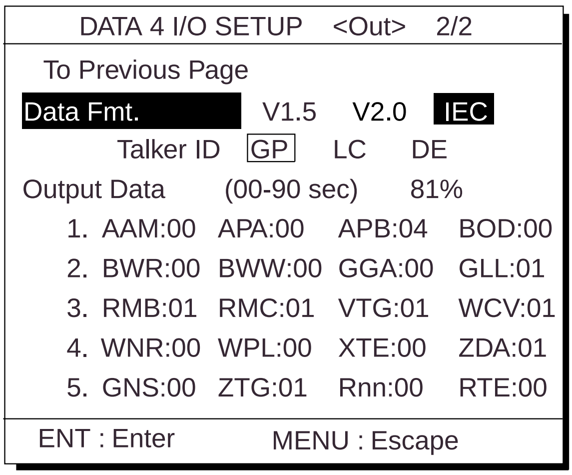


Figure 4-3 DATA4 I/O SETUP menu

7. Follow “DATA 1 output setting” from step 2.

Setting DATA 4 to "COM." (general data)

Lighthouse data can be received from a personal computer, through the DATA 4 port.

1) Press [MENU] [9] and [5].
2) Press ▲ or ▼ to select Level.
3) Press ◀ or ▶ to select level of personal computer; RS232C or RS422.
4) Press the [ENT] key.
5) Press ▶ to select Com.
6) Press ▼ to select To Next Page. The DATA 4 I/O SETUP menu appears.

```
Loading erases current data
Are you sure to load?

ENT: Yes    MENU: No
```

Figure 4-4 DATA 4 I/O SETUP menu

7) Press ▲ or ▼ to select Baud Rate.
8) Press ◀ or ▶ to select baud rate; 400bps, 9600bps, or 19200bps.
9) Press the [ENT] key.
10) Press ▲ to select L.House.
11) Press ▼ to select Command. Stop, on the same line as Command, appears in reverse video.
12) Press ▼ to select Start. The message shown in Figure 4-5 appears.

```
Now loading
Light House data !

MENU: Stop
```

Figure 4-5

13) Press the [ENT] key. The message shown in Figure 4-6 appears while data is being loaded.

```
Are you sure to stop ?


ENT: Yes    MENU: No
```

Figure 4-6

14)Output data from the computer. When data is loaded, the cursor shifts to Stop.
15)Press the [ESC] key.

Setting DATA 4 to DGPS

An external DGPS receiver can be connected to the DATA 4 port. Follow the procedure below to setup the GP-80-D according to the specifications of the DGPS receiver.
1) Press [MENU] [9] and [5].
2) Press ▲ or ▼ to select Level.
3) Press ◀ or ▶ to select level; RS232C or RS422.
4) Press the [ENT] key.
5) Press ◀ or ▶ to select DGPS.
6) Press ▼ to select To Next Page.

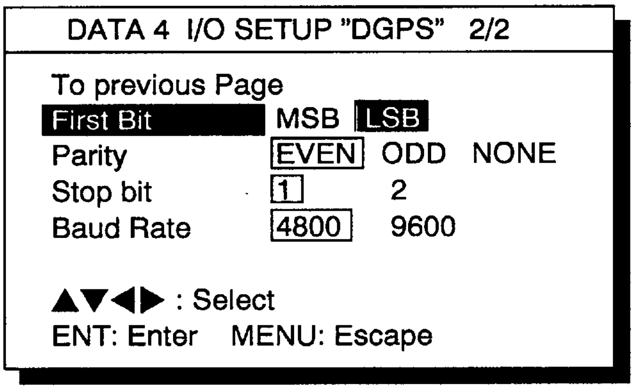


Figure 4-7 DATA 4 I/O SETUP "DGPS" 2/2 menu

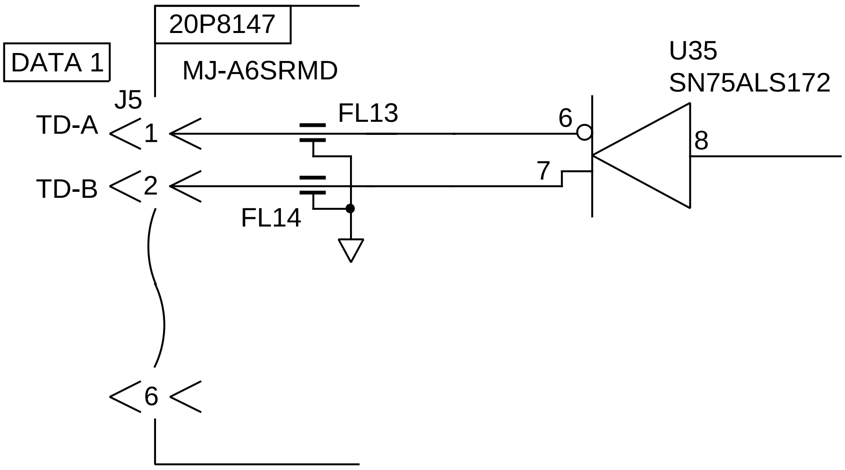
7) Press ▲ or ▼ to select First Bit.
8) Press ◀ or ▶ to select first bit; MSB or LSB.
9) Press ▼ to select Parity Bit.
10)Press ◀ or ▶ to select parity bit; EVEN, ODD or NONE.
11)Press ▼ to select Stop Bit.
12)Press ◀ or ▶ to select stop bit; 1 or 2.
13)Press ▼ to select Baud Rate.
14)Press ◀ or ▶ to select baud rate; 4800 or 9600.
15)Press the [ENT] key.
16)Press the [ESC] key.

Interface Documentation

"DATA1" Port

⊙ IEC 61162-1/NMEA 0183 Ver. 1.5 Output

- Output Schematic Diagram (Talker)

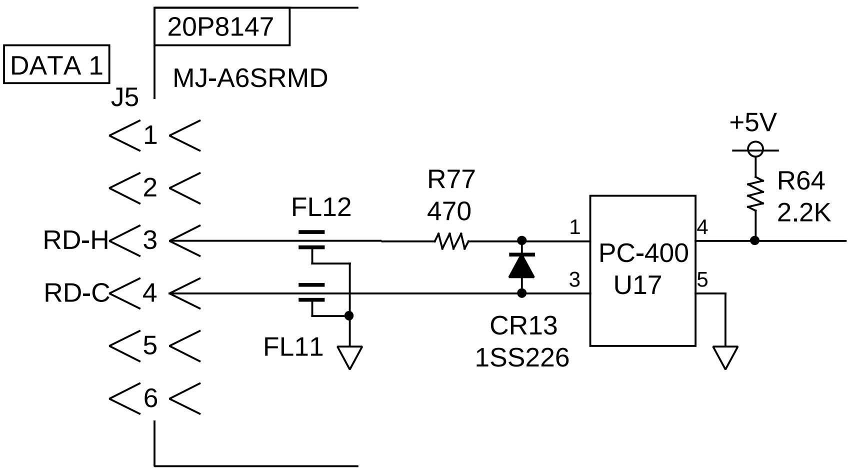


- Output Drive Capability

  Max. 10mA
- IEC 61162-1 output subject to the standard of IEC 61162-1 First edition 1995-11.
- Output Sentence is described on page 8 and 9. Each sentence is output at the interval entered.

⊙ NMEA 0183 Input

- Input Schematic Diagram (Listener)



- Load Requirements

  Isolation: opto coupler

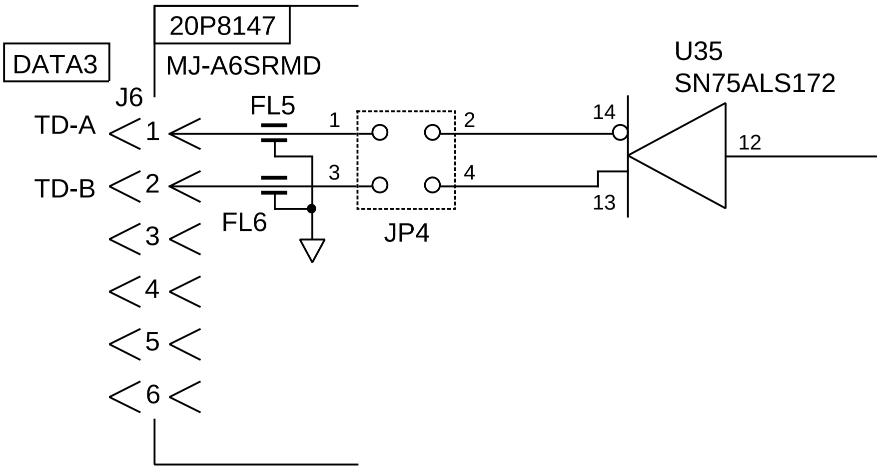
  Input Impedance: 470 Ω

  Max. Voltage: ±15V

  Threshold: 3mA (In case of FURUNO device talker connection)
- Input Sentence is described on page C-11.

"DATA3" Port

- The output signal of this port is changed by jumper JP4 and JP5 between data out (IEC 61162-1/NMEA 0183 Ver. 1.5/Ver. 2.0) and log pulse.
- In case of data out, the same data of DATA1 port (#1 & #2) is output.
- Output Schematic Diagram (Talker)



- Output Drive Capability

  Max. 10mA

"DATA4" Port

IN/OUT signal is selected by the menu among the output of IEC 61162-1, NMEA 0183 Ver. 1.5/Ver. 2.0, PC output/input and DGPS signal. Also, to select DGPS signal, jumper JP3 is required to connect "external DGPS receiver."

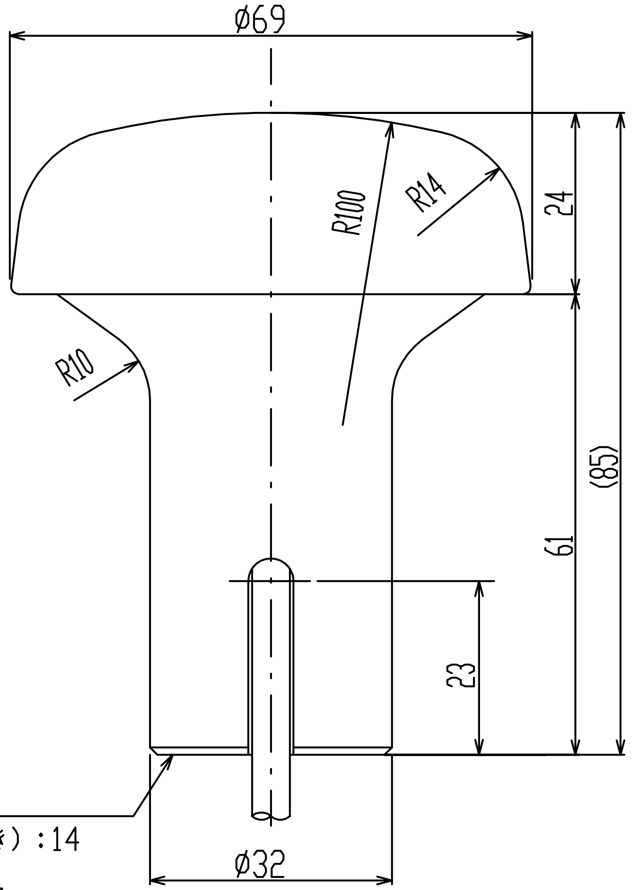
RS-232C or RS-422 level can be selected by the menu.

In case of output of IEC 61162-1, NMEA 0183 Ver. 1.5/Ver. 2.0,

- Data format can be selected by the menu between IEC 61162-1 and NMEA 0183 Ver. 1.5/Ver. 2.0.
- Output sentence is described on page C-8 and C-9.
- Each sentence is output at the interval entered.

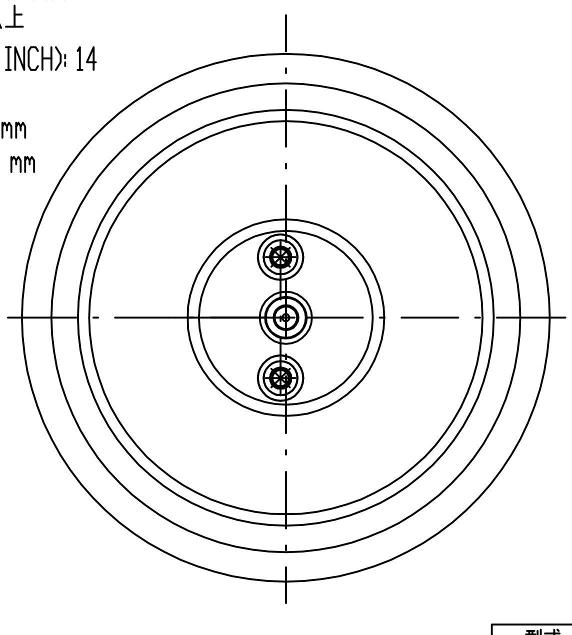
寸法区分(mm) DIMENSION	公差(mm) TOLERANCE
L ≦ 50	±1.5
50 ＜ L ≦ 100	±2.5
100 ＜ L ≦ 500	±3

表1 TABLE 1



1-14UNS1B
ねじ山数（25.4mmにつき）：14
ピッチ： 1.8143 mm
オネジ有効長さ： 24.17 mm
オネジ有効径：19 mm以上

THREAD PER 25.4mm (1 INCH): 14
PITCH: 1.8143 mm
THREAD LENGTH: 15.17 mm
PITCH DIAMETER: 24.17 mm



注記
指定外の寸法公差は表１による。

NOTE
TABLE 1 INDICATES TOLERANCE OF DIMENSIONS.

型式 TYPE	ケーブル長(m) CABLE LENGTH	プラグ PLAG	質量(kg±10%) MASS
GPA-017	10	TNC-P-3	0.6
GPA-017S	0.2	TNC-J-3	0.15

表2 TABLE 2

DRAWN Feb. 19 '03 T.YAMASAKI		TITLE	GPA-017/017S
CHECKED Feb. 19 '03 Y.KIMURA		名称	空中線部
APPROVED Feb. 19, '03 Y. Kimura			外寸図
SCALE 1/1	MASS TABLE 2 表2参照	NAME	ANTENNA UNIT
DWG.No. C4384-G04- J			OUTLINE DRAWING

FURUNO ELECTRIC CO., LTD.

1 2 3

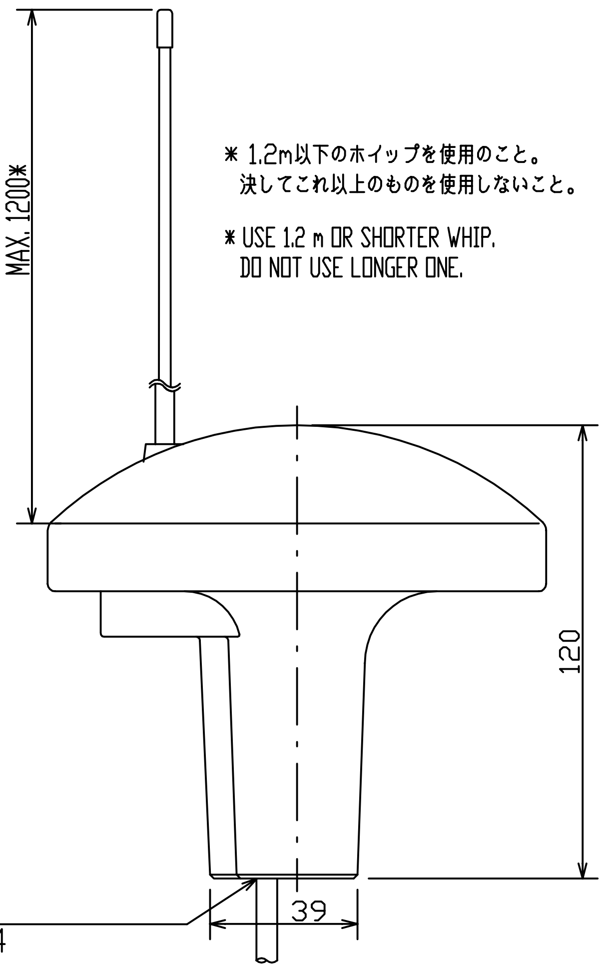
A

寸法区分 (mm) DIMENSION	公差(mm) TOLERANCE
L ≦ 50	±1.5
50 < L ≦ 100	±2.5
100 < L ≦ 500	±3

表 1 TABLE 1

＊ 1.2m以下のホイップを使用のこと。
決してこれ以上のものを使用しないこと。

＊ USE 1.2 m OR SHORTER WHIP.
DO NOT USE LONGER ONE.

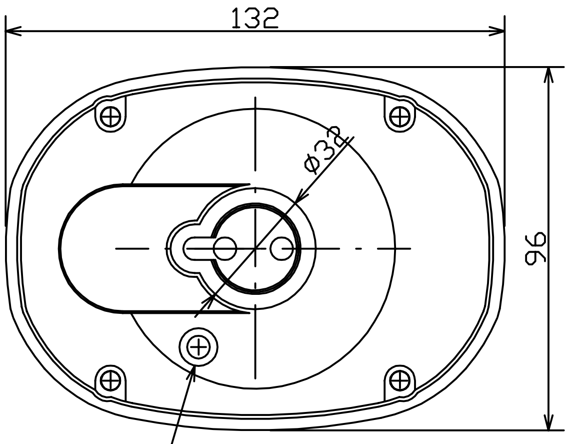


B

1-14UNS1B
ねじ山数(25.4mmにつき): 14
ピッチ: 1.8143 mm
オネジ有効長さ: 19 mm以上
オネジ有効径: 24.17 mm

C

THREADS PER INCH(25.4mm): 14
PITCH: 1.8143 mm
THREAD LENGTH: 19 mm OR MORE
PITCH DIAMETER: 24.17 mm



アース端子
GND TERMINAL

D

注記
1）指定なき寸法公差は表１による。

NOTE
1. TABLE 1 INDICATES TOLERANCE OF DIMENSIONS.

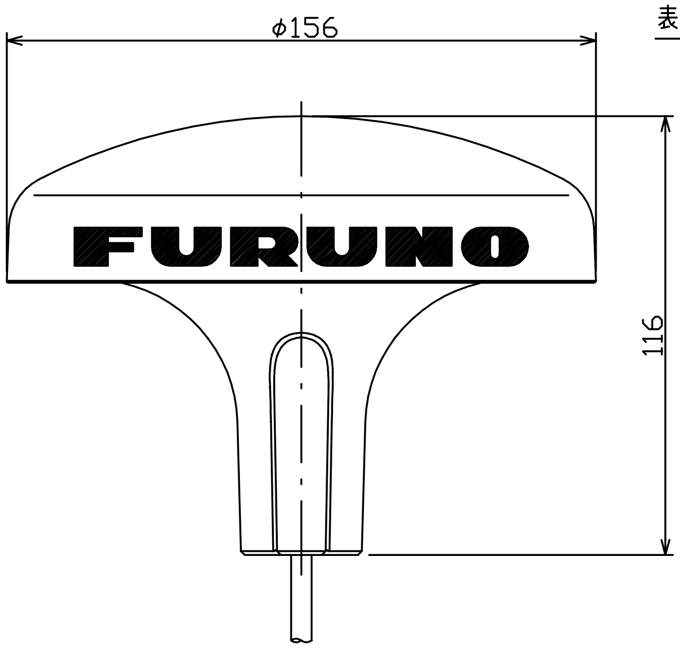
型式 TYPE	ケーブル長(m) CABLE LENGTH	プラグ PLAG	質量(kg±10%) MASS
GPA-018	10	TNC-P-3	0.79
GPA-018S	0.2	TNC-J-3	0.35

表２ TABLE 2

DRAWN Feb. 19 '03 T.YAMASAKI	TITLE	GPA-018/018S
CHECKED Feb. 19 '03 Y.KIMURA	名称	空中線部
APPROVED Feb. 19, '03 Y. Kimura		外寸図
SCALE 1/2 MASS TABLE 2 表２参照	NAME	ANTENNA UNIT
DWG. No. C4385-G01- J		OUTLINE DRAWING

寸法区分(mm) DIMENSION	公差(mm) TOLERANCE
L≦50	±1.5
50<L≦100	±2.5
100<L≦500	±3

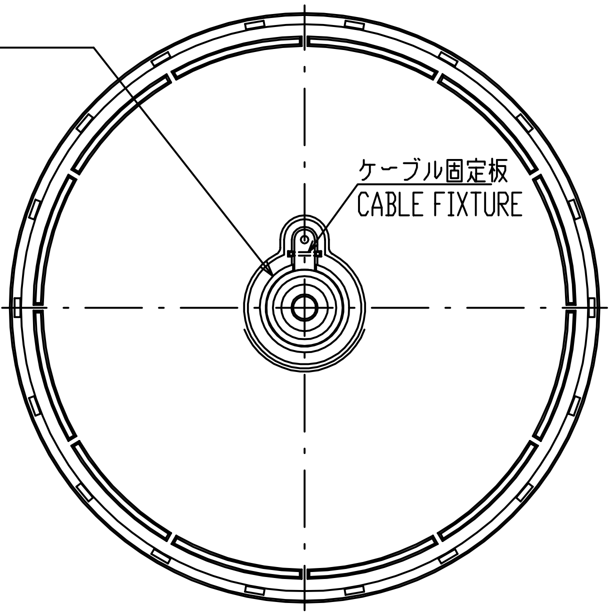
表1　TABLE 1



1-14UNS1B

ねじ山数(25.4mmにつき)：　14
ピッチ：　1.8143 mm
オネジ有効長さ：　15.17 mm
オネジ有効径：　24.17 mm

THREAD PER 25.4mm (1 INCH): 14
PITCH: 1.8143 mm
THREAD LENGTH: 15.17 mm
PITCH DIAMETER: 24.17 mm



型式 TYPE	ケーブル長(m) CABLE LENGTH	プラグ PLAG	質量 (kg±10%) MASS
GPA-019	10	TNC-P-3	1.0
GPA-019S	0.2	TNC-J-3	0.54

表2　TABLE 2

注記：　指定外の寸法公差は表1による

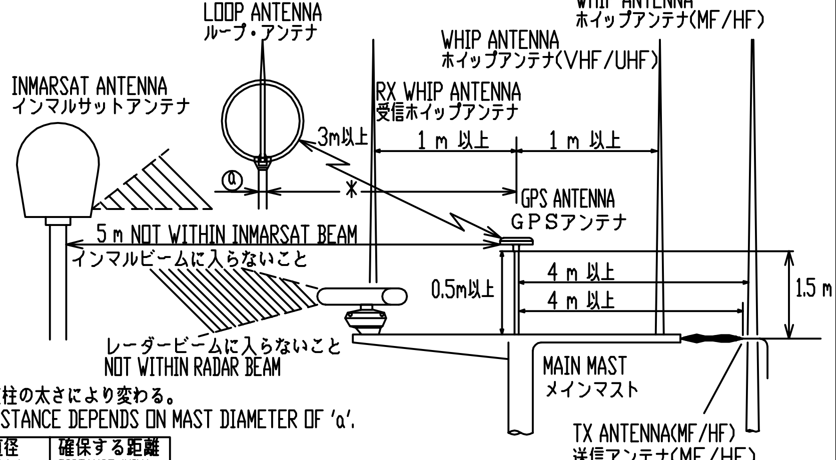
NOTE:　TABLE 1 INDICATES TOLERANCE OF DIMENSIONS.

DRAWN	Feb. 19 '03 T.YAMASAKI	TITLE	GPA-019/019S
CHECKED	Feb. 19 '03 Y.KIMURA	名称	空中線部
APPROVED	Feb. 19, '03 Y. Kimura		外寸図
SCALE	1/2 MASS TABLE 2 表2参照	NAME	ANTENNA UNIT
DWG. No.	C4400-G01- F		OUTLINE DRAWING

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取付場所
MOUNTING LOCATION

他の機器のアンテナから下の図の距離以上離す。
THIS FIGURE SHOWS THE SEPARATION DESTANCES FROM OTHER ANTENNAS TO AVOID MUTUAL INTERFERENCE.

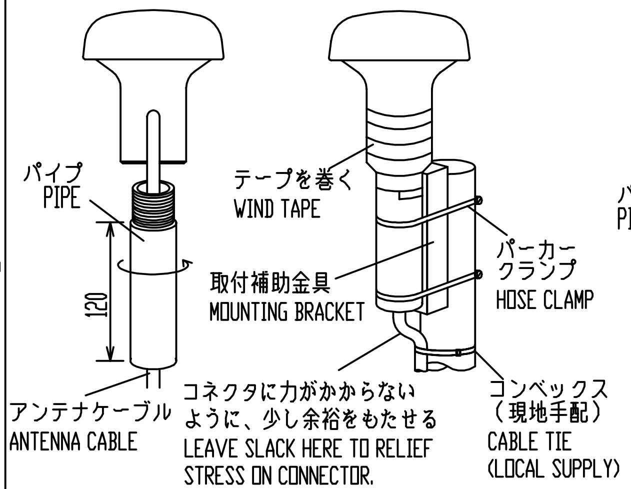


＊：支柱の太さにより変わる。
＊: DISTANCE DEPENDS ON MAST DIAMETER OF 'a'.

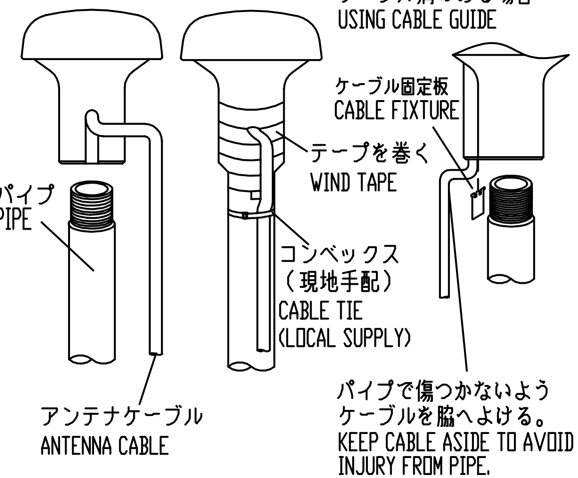
a の直径 DIA. OF 'a'	確保する距離 DISTANCE (MIN.)
10 cm	1.5 m
30 cm	3 m

A）マストへの取付け　MAST MOUNTING

a)マスト取付金具CP20-01111(工事材料)でマストに固定する。
USE MAST MOUNTING KIT CP20-01111.



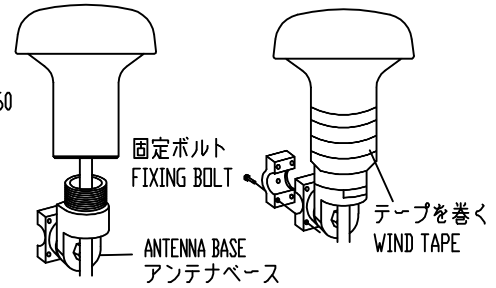
b)パイプのみを使うとき
USE A PIPE ONLY.



B）スタンションやパルピットにつけるとき

レール用アンテナベース No.13-RC5160
（取付可能レール直径：ø19～ø32）
（コード番号：000-806-114）

HANDRAIL MOUNTING
USE HANDRAIL MOUNTING BASE No.13-RC5160 (CODE No.000-806-114, OPTION).
THE DIAMETER OF THE HANDRAIL MAY BE FROM ø19mm TO ø32mm.

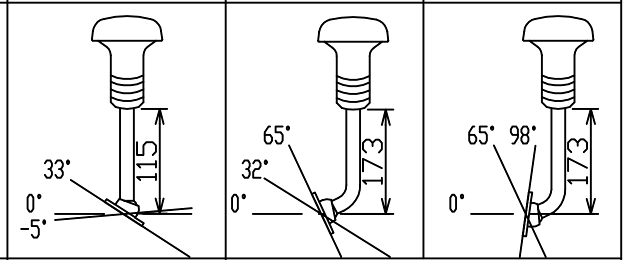


注記 1）パイプやアンテナベースはアンテナユニットにねじ込んだ後に固定する。
2）アンテナを固定するときはパイプ（アンテナベース）をアンテナにねじ込むこと。
アンテナ側をねじるとコネクタ部やケーブルに無理がかかり、故障の原因となる。

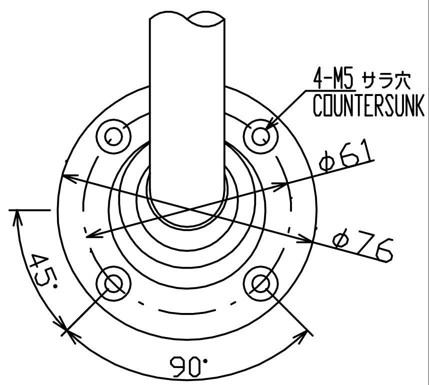
NOTE 1. FASTEN PIPE(ANTENNA BASE) TO ANTENNA UNIT FIRST THEN FIX THEM TO MAST OR HANDRAIL.
2. WHEN FIXING ANTENNA, TURN PIPE OR ANTENNA BASE; NOT THE ANTENNA. TURNING THE ANTENNA MAY TWIST THE CABLE AND PLACE STRESS ON CONNECTOR.

C）取付ける場所が傾斜しているとき　ANTENNA BASE MOUNTING

オプションのアンテナベースを使う。
USE OPTIONAL ANTENNA BASE.

傾斜 INCLINATION	-5° - 33°	32° - 65°	65° - 98°
装備方法 MOUNTING METHOD			
アンテナベース型式 ANT. BASE TYPE コード番号 CODE No.	直型アンテナベース RIGHT ANGLE ANTENNA BASE No.13-QA330 000-803-239	L型アンテナベース L-TYPE ANTENNA BASE No.13-QA310 000-803-240	

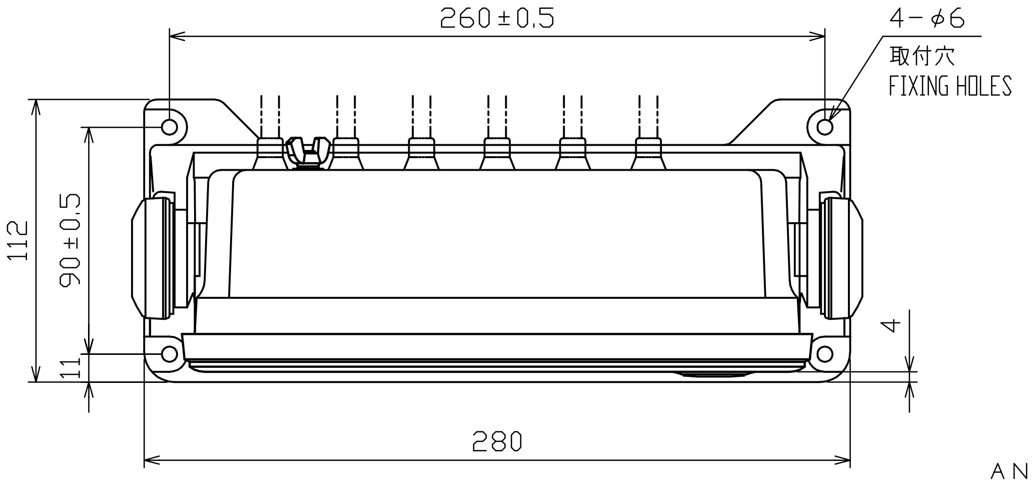
アンテナベース基部
MOUNTING DIMENSIONS OF ANTENNA BASE.

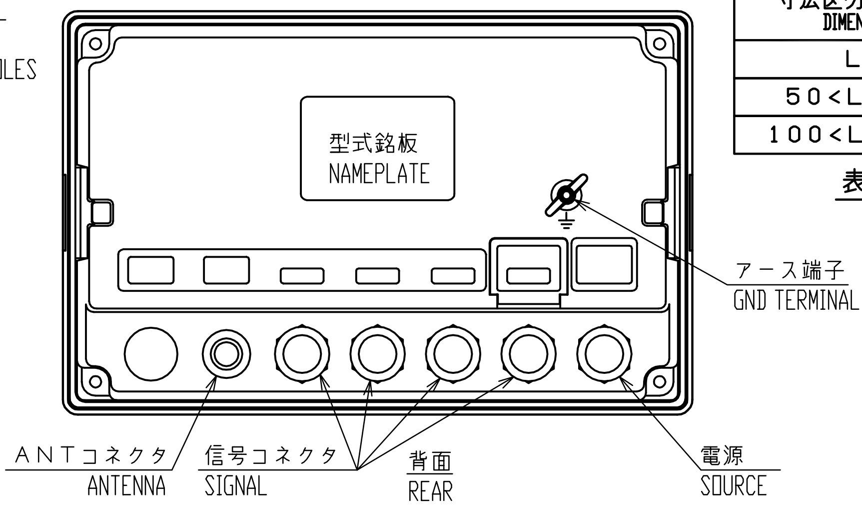


DRAWN	July 22 '02 T.YAMASAKI		TITLE	GPA series
CHECKED	July 22 '02 Y.KIMURA		名称	空中線部
APPROVED	July 22, '02 Y. Kimura			装備要領図
SCALE	MASS		NAME	ANTENNA UNIT
DWG.No.	C4384-Y01- A			INSTALLATION PROCEDURE

FURUNO ELECTRIC CO., LTD.

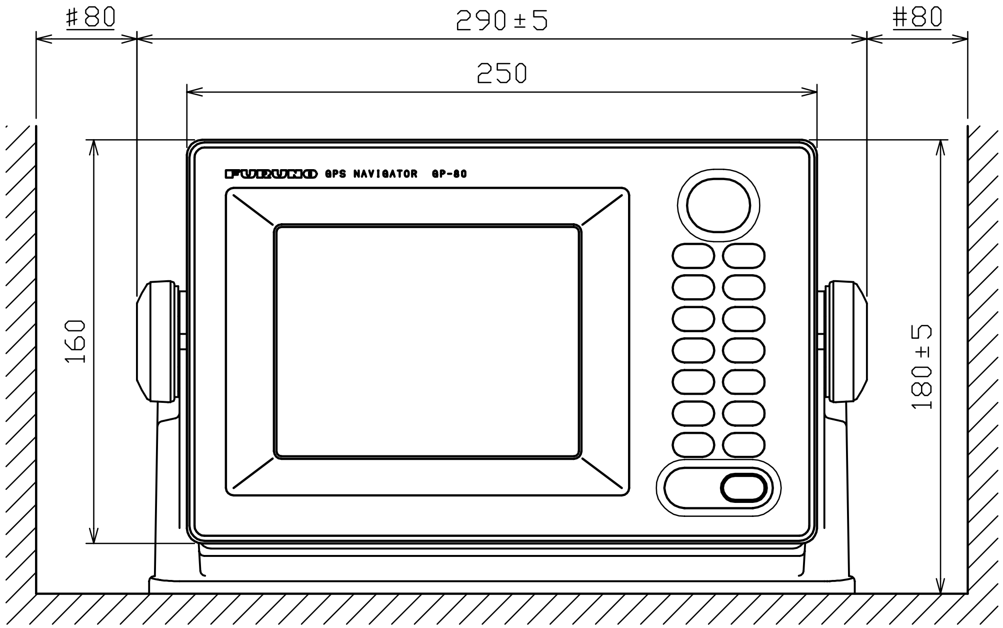
FURUNO

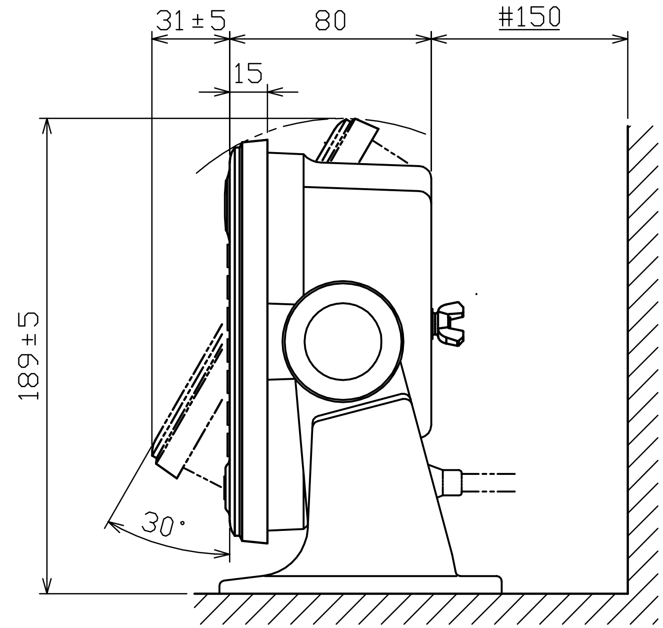




寸法区分（mm） DIMENSION	公差（mm） TOLERANCE
L≦50	±1.5
50＜L≦100	±2.5
100＜L≦500	±3

表1 TABLE 1





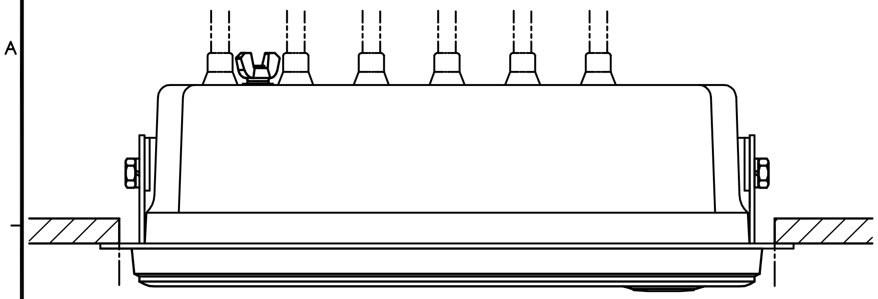
注　記　1）＃印寸法は最小サービス空間寸法とする。
2）指定外の寸法公差は表1による。
3）取付用ネジは＋トラスタッピンネジ呼び径５×２０を使用のこと。

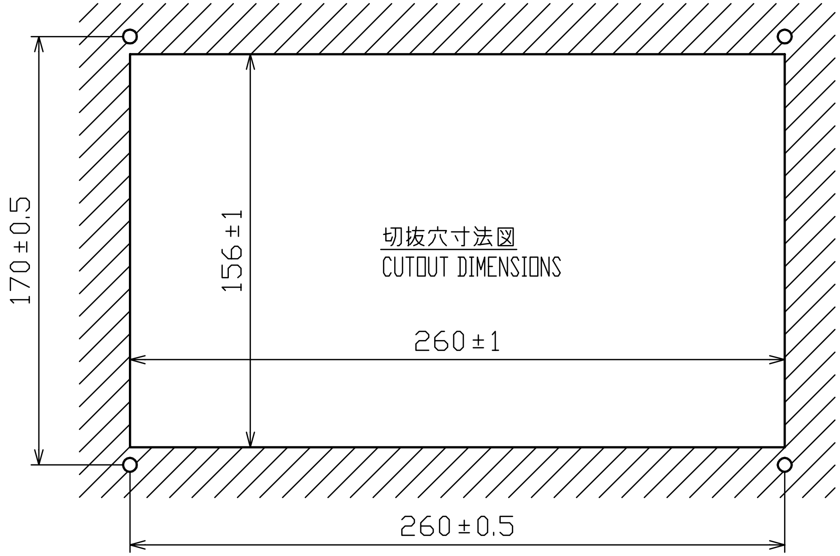
NOTE
1. #: RECOMMENDED SERVICE CLEARANCE.
2. TABLE 1 INDICATES TOLERANCE OF DIMENSIONS.
3. USE TAPPING SCREWS 5x20 FOR FIXING THE UNIT.

DRAWN Feb. 28 '03 T.YAMASAKI		TITLE	GPR-020
CHECKED Feb. 28 '03 Y.KIMURA		名称	受信演算部（卓上装備）
APPROVED Feb. 28. '03 Y. Kimura	GP-80		外寸図
SCALE 1/3 / MASS 2.2 ±10% kg	ビーコン付のとき: 2.4 kg±10% MASS W/ BEACON BOARD: 2.4 kg±10%	NAME	RECEIVER UNIT (DESKTOP MOUNT)
DWG.No. C4374-G01-E	20-013-100G-2		OUTLINE DRAWING

FURUNO ELECTRIC CO., LTD.

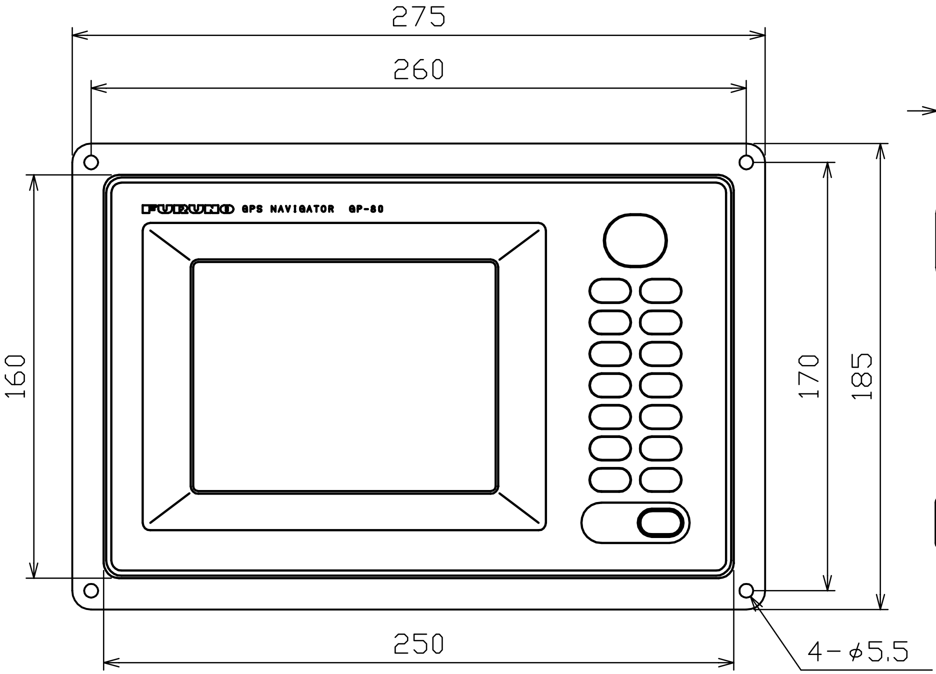
FURUNO

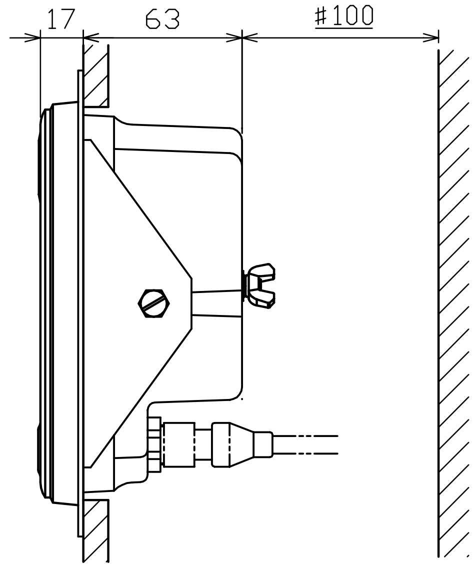


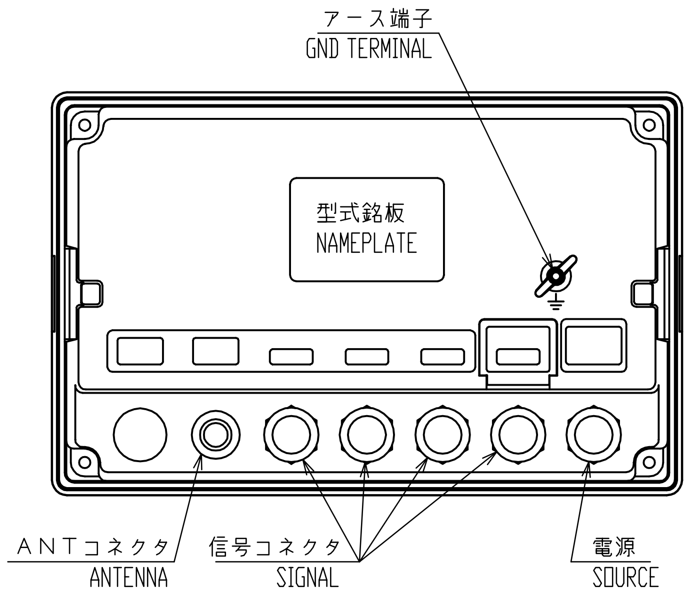


寸法区分（ｍｍ） DIMENSION	公差（ｍｍ） TOLERANCE
Ｌ≦５０	±１．５
５０＜Ｌ≦１００	±２．５
１００＜Ｌ≦５００	±３

表１ TABLE 1







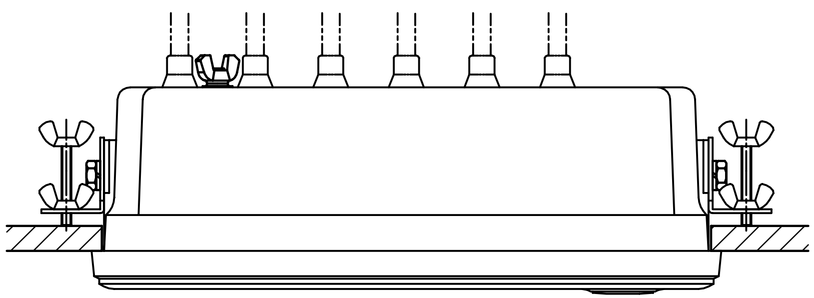
注　記　１）＃印寸法は最小サービス空間寸法とする。
　　　　２）指定外の寸法公差は表１による。
　　　　３）取付用ネジは＋トラスタッピンネジ呼び径５×２０を使用のこと。

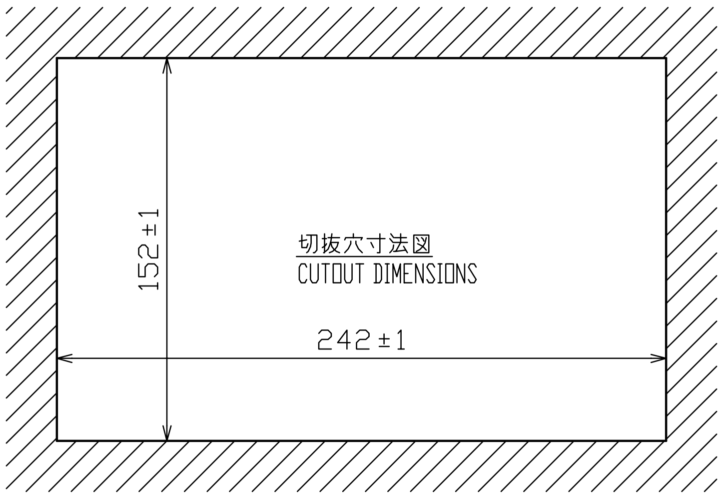
NOTE
1. #: RECOMMENDED SERVICE CLEARANCE.
2. TABLE 1 INDICATES TOLERANCE OF DIMENSIONS.
3. USE TAPPING SCREWS 5x20 FOR FIXING THE UNIT.

DRAWN	Feb. 28 '03 T.YAMASAKI	TITLE	GPR-020
CHECKED	Feb. 28 '03 Y.KIMURA	名称	受信演算部（埋込装備F）
APPROVED	Feb. 28, '03 Y. Kimura	GP-80	外寸図
SCALE 1/3	MASS 2.2 ±10% kg	ビーコン付のとき: 2.4 kg±10% MASS W/ BEACON BOARD: 2.4 kg±10%	NAME RECEIVER UNIT (FLUSH MOUNT F)
DWG.No.	C4374-G02- E	20-013-112G-1	OUTLINE DRAWING

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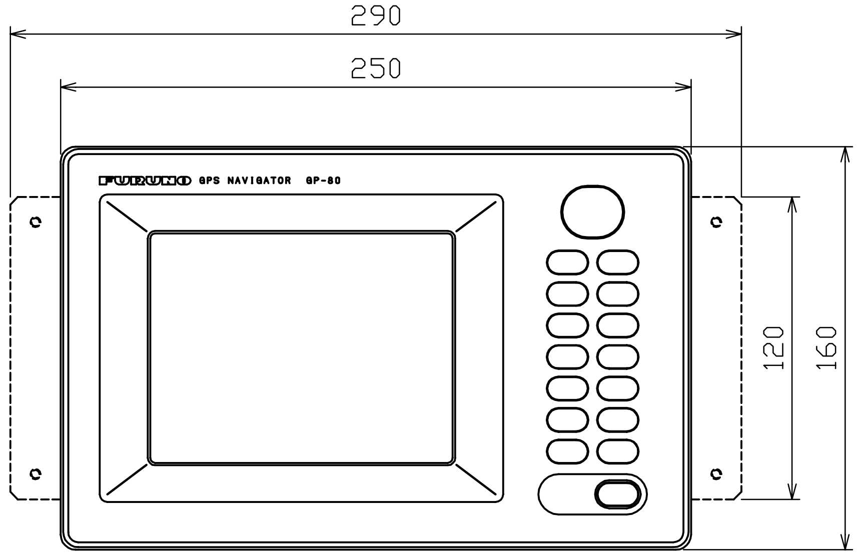
FURUNO

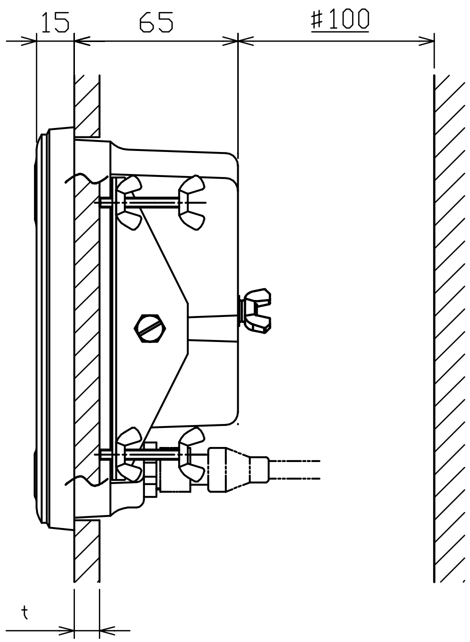


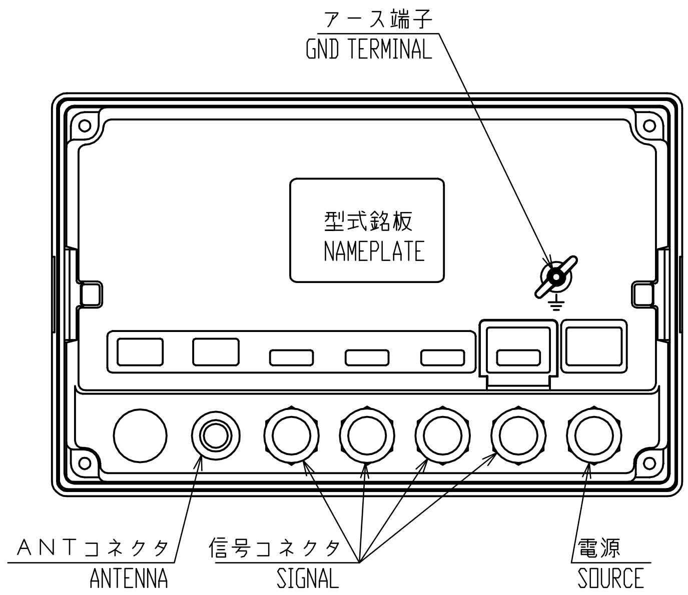


寸法区分（mm） DIMENSION	公差（mm） TOLERANCE
L≦50	±1.5
50<L≦100	±2.5
100<L≦500	±3

表 1 TABLE 1







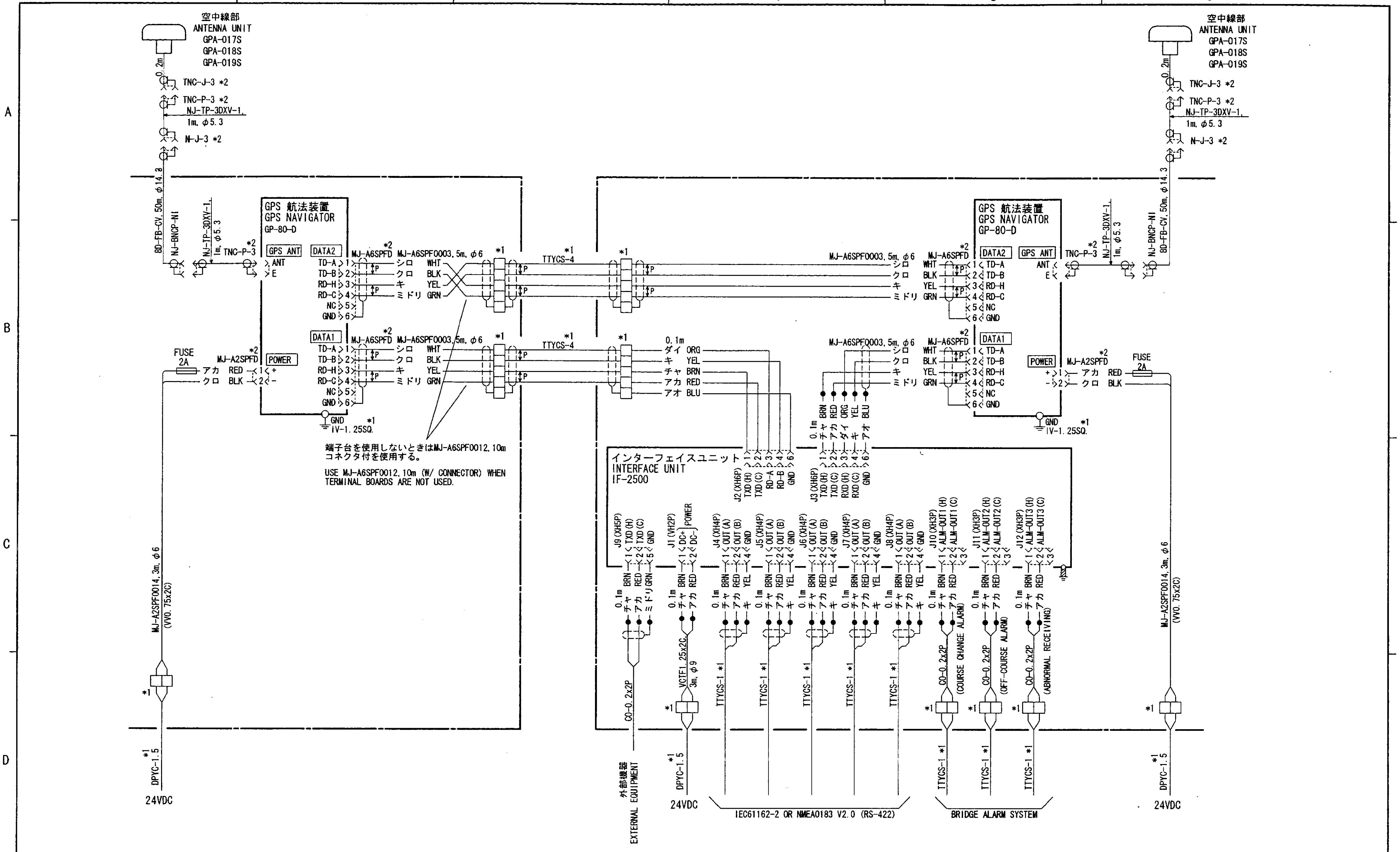
注　記　1）＃印寸法は最小サービス空間寸法とする。
2）指定外の寸法公差は表１による。
3）壁の厚さ（ｔ）は、１２までとする。

NOTE
1. #: RECOMMENDED SERVICE CLEARANCE.
2. TABLE 1 INDICATES TOLERANCE OF DIMENSIONS.
3. THICKNESS OF BULKHEAD (t) SHOULD BE WITHIN 12 mm.

DRAWN Feb. 28 '03 T.YAMASAKI		TITLE	GPR-020
CHECKED Feb. 28 '03 Y.KIMURA		名称	受信演算部（埋込装備）
APPROVED Feb. 28, '03 Y. Kimura	GP-80		外寸図
SCALE 1/3	MASS 2.2 ±10% kg ビーコン付のとき: 2.4 kg±10% MASS W/ BEACON BOARD: 2.4 kg±10%	NAME	RECEIVER UNIT (FLUSH MOUNT S)
DWG.No. C4374-G03-E	20-013-111G-1		OUTLINE DRAWING

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注記
＊1）造船所手配。
＊2）工場にて取付済み。

NOTE
*1. SHIPYARD SUPPLY.
*2. FITTED AT FACTORY.

CO-0.2x2P : CO-SPEVV-SB-C 0.2x2P, φ10.5
CO-0.2x5P : CO-SPEVV-SB-C 0.2x5P, φ13.5

DRAWN Jan. 28 '03	T. YAMASAKI	TYPE	DD-80
CHECKED Jan. 28 '03	Y. KIMURA	名称	GPS航法装置
APPROVED Jan. 28, '03	Y. Kimura		相互結線図
SCALE	MASS kg	NAME	GPS NAVIGATOR
DWG. NO.	C4374-C06- A		INTERCONNECTION DIAGRAM

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